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HEALTH EFFECTS OF INDOOR AIR POLLUTION

HEARING

BEFORE THE

SUBCOMMITTEE ON
ENVIRONMENTAL PROTECTION

OF THE

COMMITTEE ON
ENVIRONMENT AND PUBLIC WORKS
UNITED STATES SENATE

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HEALTH EFFECTS OF INDOOR AIR POLLUTION

FRIDAY, APRIL 24, 1987

U.S. SENATE,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
SUBCOMMITTEE ON ENVIRONMENTAL PROTECTION,
Washington, DC.

The subcommittee met at 9:32 a.m. in room SD-406, Dirksen Senate Office Building, Hon. George J. Mitchell (chairman of the subcommittee) presiding.

Present: Senators Mitchell, Lautenberg, Chafee, Durenberger, and Pressler.

OPENING STATEMENT OF HON. GEORGE J. MITCHELL, U.S. SENATOR FROM THE STATE OF MAINE

Senator MITCHELL. Good morning, ladies and gentlemen. I welcome you all to this hearing on indoor air pollution.

For several months, this subcommittee has been conducting a series of hearings in preparation for reauthorization of the Clean Air Act. When the Act was first passed, it was generally understood that it focused on ambient or outdoor air quality rather than the quality of air indoors.

Since the Clean Air Act was passed, however, our society has learned a good deal about health threats posed by contaminants in the indoor air.

Some years ago, we learned that high levels of radon gas in homes may account for as many as between 5,000 and 20,000 lung cancer deaths each year. More than any other factor, radon has focused public attention on the seriousness of the health effects of contaminants in the indoor air. Radon has helped to dismiss the notion that indoor air contaminants are simply an irritation or an inconvenience.

There is growing evidence of the seriousness of health threats posed by a wide range of other indoor air contaminants. EPA studies of the total exposure to air pollutants have identified higher concentrations of some contaminants in indoor air than in outdoor air.

In some cases, these contaminant concentrations are over ten times greater indoors than they are outdoors. A study by the Consumer Product Safety Commission of 40 typical homes produced similar conclusions.

In addition, because most people spend up to 90 percent of their time indoors, these high levels of indoor air pollutants have the potential to pose risks to human health greater than those experienced outdoors.

The full extent of the health risks of those exposures is not certain. EPA estimated recently that indoor air pollutants other than radon account for as many as 3,500 to 6,500 cases of cancer each year. This estimate does not include some of the major air contaminants indoors such as asbestos, worker exposure to contaminants or exposure to pesticides applied indoors.

Indoor pollution problems may, unfortunately, get worse rather than better in the years ahead. Evidence indicates that increasing levels of home insulation used for energy conservation also have the effect of increasing the chances of harmful levels of contaminants in indoor air, and the range of potential sources of contaminants, such as through the use of consumer products, continues to grow.

We have made some progress in response to the indoor air and radon problems. Last year, Congress enacted legislation, which I introduced, directing the EPA to establish a research program on indoor air and radon. Congress also enacted Senator Stafford's bill addressing control of asbestos in schools.

This year, we continued our work on the problem. I have introduced legislation to assist states in development of programs to respond to radon problems. Senator Chafee has introduced legislation calling for a national survey of radon in schools, and Senator Stafford has introduced legislation addressing asbestoes in public buildings.

This hearing offers the chance to look at the broader problem of indoor air pollution; to review scientific findings concerning the health threats posed by these contaminants; and to hear testimony on possible policy responses to the problem. Based on this testimony and other information, we will consider whether additional legislation addressing indoor air is needed or whether the Clean Air Act or some other statute is the proper vehicle for this effort.

Let me emphasize that any response to the indoor air problem will be in addition to and not at the expense of of our effort to improve the quality of outdoor air.

I believe that we have clear evidence of the health problem resulting from indoor air pollution and that an effective and coordinated response to this problem must be considered by this Committee and this Congress. I look forward to hearing from our witnesses today concerning the seriousness of the health threat and their suggestions as to the best way to respond to the problem.

Now I would like to recognize our distinguished ranking member, the foreman chairman of this subcommittee, Senator Chafee.

OPENING STATEMENT OF HON. JOHN H. CHAFEE, U.S. SENATOR FROM THE STATE OF RHODE ISLAND

Senator CHAFEE. Thank you very much, Mr. Chairman. First, I want to again commend you for pressing ahead with these hearings and investigating this problem so thoroughly. We are delighted to have Mr. Barnes with us.

Mr. Chairman, as you have mentioned, it is estimated that the average person spends up to 90 percent or more of his or her time indoors. Yet until recently, most of the attention that we spent on

environmental matters dealt with outdoors and little to indoor air environment. There are major contaminants and pollutants indoors, such as radon and asbestos.

These that you mentioned and brought to the public's attention. But there are others: formaldehyde in pressed wood products; methyl chloride in paint remover; lead, mercury, and other inorganics make their way into the indoor air environment.

Of all the indoor pollutants, radon gas is the most harmful, and under your leadership, Mr. Chairman, we had a good hearing on that last week. In a recent study of environmental and health risks, EPA ranked exposure to radon gas as posing the greatest overall risk of cancer among a group of 26 pollution sources which were addressed.

It is estimated that between 5,000 and 20,000 people die each year of lung cancer from exposure to radon. As you mentioned, Mr. Chairman, you and I have introduced legislation which calls for a national survey of radon in the nation's schools and establishes a program for assistance to our schools.

In addition, the health risks from inhaling asbestos is of great concern. I believe it will be of interest that my State of Rhode Island has been a leader in tackling the asbestos problem and has one of the most comprehensive asbestos laws in the country. Rhode Island regulates the removal or containment of asbestos and has set aside $20 million, which is a lot for a small state like ours, to assist homeowners in ridding houses of asbestos.

Perhaps more importantly, Rhode Island has embarked in a major campaign to educate people about this public health problem. In our State, we offer free classes in 35 communities and have produced a 20-minute videotape entitled "Asbestos in the Home."

Rhode Island's approach is significant because it tackles the problem of asbestos exposure through education.

We believe the informed consumer can be the best person who can deal with this. I am delighted to be here, Mr. Chairman, and I look forward to the testimony of those fine witnesses that you have presented us with.

Thank you.

Senator MITCHELL. Thank you very much, Senator Chafee. Our first witness today is Mr. A. James Barnes, Deputy Administrator of the Environmental Protection Agency.

Mr. Barnes, we, again, welcome you. It may be useful for the Committee members and the record for you to identify your associates that joined you today. We welcome them, as well. As those who appear before this Committee regularly know, the Committee rules require that witnesses submit their written statements in advance; that the full written statements be inserted in the record, and that the witness be asked to summarize their statements in five minutes of oral testimony.

Mr. Barnes, since you represent the Administration and the Agency principally responsible in this area, as we always have, we will ask you to take whatever time you feel necessary to deal with the subject. If you can do it in about ten minutes, that would be helpful. We will hold the other witnesses to the five-minute rule. So I give them some advance notice in the event they want to review their remarks.

As always, Mr. Barnes, we welcome you, and we look forward to hearing from you.

STATEMENT OF A. JAMES BARNES, DEPUTY ADMINISTRATOR, ENVIRONMENTAL PROTECTION AGENCY, ACCOMPANIED BY DONALD EHRETH, DEPUTY ASSISTANT ADMINISTRATOR, OFFICE OF RESEARCH AND DEVELOPMENT; VICTOR J. KIMM, DEPUTY ASSISTANT ADMINISTRATOR, PESTICIDES AND TOXIC SUBSTANCES; EILEEN CLAUSSEN, OFFICE OF AIR AND RADIATION

Mr. BARNES. Thank you very much, Mr. Chairman. I am, again, pleased to be able to participate with you here today in a discussion of a very important public health issue. I am accompanied today by, on my immediate right, Don Ehreth, who is Deputy Assistant Administrator in our Research and Development Office, and who has, for some time, been EPA's representative to the Committee on Indoor Air Quality.

On his right is Vic Kimm, who is our Deputy Assistant Administrator in the Office of Pesticides and Toxic Substances, and on my left is Eileen Claussen, who is the Director of our Office of Program Development in our Air and Radiation Office, which is the home of our newly established effort on indoor air.

I will, as you suggested, Mr. Chairman, submit my statement for the record and simply highlight a few aspects of it. I think I can do that within the five-minute period. You and Senator Chafee very succinctly set forth the history of our efforts and concerns about air pollution. The main focus, historically, has been ambient or outdoor air, but increasingly, we are concerned about indoor air and have come to realize that we find pollutants in every building; and that indoor air pollution varies considerably by season, by building age, by type of heating, by the appliances you find in a building by ventilation by the products in use, and by the personal habits of the occupants. We are also finding that the health effects that are being associated with indoor air pollutants can range from minor irritations like headaches to much more serious, long-term chronic health effects.

Again, you articulated a number of the factors that have led us to increased concern about pollutants in the indoor air—the levels that we are finding them at the time that people spend indoors. I think it is critical for us, therefore, to acknowledge that we do have a number of major data gaps in our knowledge about indoor air pollution. Efforts like our TEAM study have been important contributions, contributions to building our base of knowledge, but we really, in the human exposure side, need to do a lot of work to more properly characterize both the magnitude of the indoor air problem and assess the risks that various pollutants pose to human health.

Over the last few years, a major focus of our research effort on indoor air has been directed at data efficiencies with respect to exposure. I believe we have been a leader with respect to developing monitoring devices for volatile and semivolatile organics and other pollutants.

We have developed test chambers so that we are able to detect emissions or detect the measure the rate of emissions that come off of various products, and we have been working on models to help predict and project indoor air quality and concentrations of pollutants.

What I would like to do is just very briefly highlight two areas: One, what we have done on the regulatory side with respect to indoor air pollution; and then briefly outline the steps that we see ourselves taking in the future.

From a regulatory standpoint, we have already addressed a number of chemicals and pesticides that are found indoors through the authorities that we have under TSCA and FIFRA, which do give us the opportunity to address substances that pose an unreasonable risk to human health.

Those include asbestos, which both you, Mr. Chairman, and Senator Chafee mentioned. We have an asbestos worker protection rule to protect public employees that are not covered by OSHA; we also proposed basically a phase-out and ban rule for asbestos to phase it out of active use in the society over the next ten years.

Earlier this week, we announced proposed regulations under the Asbestos Hazard Emergency Response Act which you passed last October.

A couple of weeks ago, we had an opportunity to discuss what we have done with respect to radon, the non-regulatory approach to try to mitigate risks from radon exposure.

On termiticides, the agency is currently evaluating data that we requested from a number of registrants on health effects and benefits with respect to chlordane and other termiticides and we expect to make a regulatory decision this summer.

A couple of years ago, we canceled most uses of the pesticide lindane, which is another indoor fumigant addressed to pests. We recently called in data on a number of disinfectants. Where their products or their claim is that they will kill germs, we have asked the registrant to produce a series of data, much of it which goes to human exposure, with respect to those disinfectants.

Last year, we examined the use of pentachlorophenol as a wood preservative, a treatment of logs for log home construction; and prohibited the use of that chemical and creosote for indoor use.

A couple of weeks ago, we announced that we completed our risk analysis for formaldehyde, which concluded that it is a probable human carcinogen and we are now moving to evaluate regulatory actions that may be necessary, particularly with respect to plywood and particle board.

Under the Safe Drinking Water Act, we have proposed to reduce exposure to volatile chemicals that can escape from tap water.

Turning to our indoor air program, Mr. Chairman, again, as you mentioned, Title IV of the SARA amendments for the first time gave EPA a clear mandate to establish a federally-coordinated indoor air and radon research program.

I want to stop for just a minute and compliment you, Mr. Chairman, for what I think was a very effective and well-targeted measure. Sometimes, sitting on the Agency end of things, we think Congress is telling us to do something we are already doing or sometimes telling us some things we don't think we ought to do. This

was a classic example of your devising a very well-targeted, right on the mark measure that now has us on a course of doing what we should do. That is, to develop a comprehensive assessment of what we know about indoor air problems in the world; identify where there are research gaps—knowledge gaps that we need to fill—develop a plan to fill those in in a logical way; and then assess what action we should be taking based on that knowledge, either knowledge we have or on the basis of the new knowledge as we attain it.

Basically, the Agency is following through on that effort and will be shortly delivering to Congress the report that sets forth that review of the literature on the research plan.

What I would like to do, now, is to just briefly outline the five basic elements that we are going to be following with respect to our indoor air program. First, we will be doing work on risk characterization so that we do a better job of characterizing the magnitude of indoor air problems and assessing the risks. This will entail looking at what the sources of those pollutants are; what the exposure of citizens is to those pollutants and what the health effects of those pollutants are.

Second, ranking those air problems for further research or mitigation efforts.

Third, identifying and evaluating appropriate mitigation and prevention strategies and focusing on both pollutant-specific strategies as well as strategies that get at multiple pollutants; for example, looking at ventilation-related strategies or air cleaning-related strategies.

Fourth, implementing those strategies, including use of regulatory tools that we have and considering whether public information and technical assistance programs such as we have with radon are the appropriate way to deal with a particular problem; using both our regulatory tools and the authority you gave us in SARA for public information dissemination; referring problems to other Federal agencies where they have authorities that can be used; and finally, where we identify shortcomings and regulatory authority, coming back to you and seeking help there.

And fifth, we are working to strengthen our coordination within the Federal family so that we avoid duplication and have a more coordinated Federal effort. I think that, in sum, the indoor air problems that we are looking at are complex problems; they are somewhat formidable challenges for us. I believe we are on the early side of a curve in terms of developing a comprehensive program, but I am confident that, particularly with the direction that you have given us and the efforts that are now under way, we are going to be able to make substantial progress toward ensuring a healthy indoor environment.

At this point, Mr Chairman, I conclude my remarks and would be happy, along with my colleagues, to respond to your questions.

Senator MITCHELL. Thank you very much, Mr. Barnes, for your statement.

In accordance with the Committee practice, questions will occur in the order in which Senators appear at the hearing. The first time, at least, we would be limited to five minutes.

Mr. Barnes, in my opening statement, I mentioned some of the EPA estimates regarding the adverse effects of indoor air pollution, notably, the contribution to cancer. The EPA's recent report assessing the relative risks of various environmental problems ranked indoor air pollution in the top five of some 30 environmental problems, and the report itself notes that the rankings do not correspond well with EPA's current program priorities.

That is, the budget for indoor air and radon is very small in comparison to other areas. It is remarkable that an environmental problem posing such a serious human health threat has received so little attention.

My first question is: Does the EPA plan to change its priorities to expand attention to indoor air problems?

Mr. BARNES. Yes, Mr. Chairman, it is my expectation that we will, although we thought we were on the course to setting in motion an expanded effort a couple of years ago at the same time we accelerated our radon problem. Our progress has not been as rapid as we would have liked on the indoor air front, but recently, we held a major planning meeting at Shepherdstown, West Virginia. Indoor air was listed and agreed upon as one of the major priorities of the Agency.

That ranking feeds into the internal budget hearings that we will be having in July, and one of the major issues of the Administrator now will be looking at is what increased focus we should have on the indoor air issue. As I think you have correctly indicated, from a risk basis, the risks are there, and it warrants increased attention.

Senator MITCHELL. Do you now plan or are you developing plans to seek higher funding levels for indoor air quality work in the future?

Mr. BARNES. We will be looking at this issue in the context of the 1989 budget, as part of the budget process, which we take up within the Agency in July.

Senator MITCHELL. As you know, the EPA Science Advisory Board recommended late last year that you at the Agency, and I will now quote your advisory board:

> Develop and adopt a clear policy statement that indoor air quality is an important and essential component of its responsibility. The policy should state the broad objectives that are the highest priority of the EPA. Such an indoor air policy statement would serve the Office of Air and Radiation in providing the total exposure perspective the mandated responsibilities to assure clean air to the U.S. population.

My question is, has the EPA developed such a policy as recommended by your Science Advisory Board?

Mr. BARNES. Mr. Chairman, we are drafting that policy. We envision that the second phase of the report that we owe you under SARA will basically outline that philosophy.

In addition, we are looking at a possible further step, where we would take the proposed policy and some goals and put it out for public comment so that we would have the interested public participate with us in what the statement of that program and the goals of the program should be.

Senator MITCHELL. Where are you in that process now?

Mr. BARNES. On the next steps with respect to the second phase of the report, that is now under interagency review. The other

members of the CIAQ are looking at it. It will go, I believe, to OMB next week, so that as I say, we are really in the final stages of being able to come back to the Congress with that report.

Senator MITCHELL. It is always ominous when you tell us it is going to OMB.

Senator MITCHELL. It may be in the final stages in numbers of agencies to which you send it, but I would like you to provide to me and to the Committee in writing a periodic report on the progress of that; when you sent it to OMB; when you get it back or when you hope to get it back; and things of that nature.

Mr. BARNES. Okay.

[The following information was subsequently supplied:]

The proposed indoor air quality research implementation plan report pursuant to section 403 (d) of the Superfund Amendments and Reauthorization Act of 1986 went to the Office of Management and Budget for inter-agency clearance on May 27, 1987 and will be forwarded to the Congress as soon as clearance is received. The proposed report incorporates comments received from other Federal agencies as well as from internal review. We will keep you apprised of the progress of inter-agency clearance as requested.

Senator MITCHELL. We found, unfortunately, in the past, that sometimes when things go to OMB, they never come back, and so we do ask you to do that.

Is it your position at the Agency that the Clean Air Act does not provide any authority for research of indoor air problems or a response to these problems?

Mr. BARNES. Mr. Chairman, historically the Agency has taken the view that the authority we had under the Clean Air Act allowed us to look at total exposure to air pollutants, and so that we were able to do some research under that statute. With respect to regulatory authority inside the agency, there was doubt that the Clean Air Act reached to that extent. We have interpreted it to allow us to do some research, particularly as it has enabled us to put into perspective the relative contributions of air pollution, the total exposure to pollutants an individual has had and was receiving within a dwelling or a work place.

Senator MITCHELL. Would you follow that up in writing with a written analysis of those provisions of the Clean Air Act that you feel do give you authority?

Mr. BARNES. I would be pleased to do so, Mr. Chairman.

Senator MITCHELL. What is the EPA view of the idea of setting numerical standards for contaminants like those set outdoors for some specified indoor environments?

Mr. BARNES. Mr. Chairman, to my knowledge, we do not believe we have that authority to do that under the Clean Air Act, and particularly, looking at the legislative history of that Act. It probably is also an issue we want to look at, whether setting standards makes sense as an approach to dealing with indoor air problems, whether the SIP process and the ambient standard approach that we use with respect to pollutants in the ambient air would be or is the best way to go about addressing indoor air problems.

Senator MITCHELL. As you know, there is already some reference to indoor standards in asbestos and radon. Specifically, with respect to radon, are you satisfied that the action level established for indoor exposure to radon is appropriate? That level which rep-

resents a cancer risk of roughly one in 30, do you regard that as acceptable and generally in accord with the degree of risk in other environmental law?

Mr. BARNES. Mr. Chairman, I recall that we had a little discussion on that a couple of weeks ago. We indicated that our four picocuries per liter action level is not set as a safe level. It was based essentially on our assessment of what was technologically possible and not a risk level in the same range as those for which we are setting safe levels for other pollutants. I might add, since Senator Chafee asked me about it last time, that a number of the European countries that have set standards here use the four picocuries per liter as the action level for new dwellings and most of them use about 20 picocuries per liter for old dwellings.

So I believe that the United States, in terms of looking at other developed countries, is higher on the protective side but still, Mr. Chairman, not necessarily in the same range as we would be with a lot of the other chemicals for which we purport to set safe levels.

Senator MITCHELL. Thank you.

Senator Chafee.

Senator CHAFEE. Thank you, Mr. Chairman.

Mr. Barnes, it is my understanding that there are some 16 Federal agencies involved in this indoor air-related program. On page 9 of your testimony, you indicated that this is probably a pretty good set-up, you said:

> In many respects, mitigation of the most serious indoor air pollution problems is feasible only because of the large number of Federal, State, local and private sector agencies with indoor-related responsibilities * * *

To us sitting here, it seems to me, any program that has 16 agencies meddling around in it is a formula for disaster.

You seem to think that it is all right. Could you briefly amplify on that?

Mr. BARNES. Mr. Chairman, I think you have put a gloss on that that I would not have intended. What I meant here was that in looking to deal with the panoply of indoor air problems that we look at, one really has to go through almost the alphabet soup of Federal agencies. For example, you have the Consumer Product Safety Commission that has been set up to deal with them; some HUD; some DOE; some OSHA with respect to the work place.

What I was saying is that you are able to get at the problem only because you have to look to what the whole set of resources and authorities is out there.

Certainly, the Congress is looking at how we are approaching the indoor air problem. That is one thing that I am pleased to see that you are focusing on, namely just how these Federal authorities fit together. We find that the CIAQ is helpful in terms of trying to avoid duplication and sometimes to help new things cooperatively, but it still is, as I think you are suggesting, a rather awkward way to try and figure out, when you have got an asbestos problem someplace, should it be OSHA's? Should it be CPSC's? Should it be EPA's? Who has the lead? Or do all of us have to work together?

Senator CHAFEE. If you had the authority, who would you put in charge? Seriously. I am not throwing rocks at any of the other agencies. My question to you is: Do you think EPA should be put in

charge overall? I suppose you can never be completely in charge. There is the Consumer Product Safety Commission and HUD. I suppose HUD sets some housing standards, don't they?

Mr. BARNES. That is correct. Certainly, with respect to manufactured housing and formaldehyde, that was an area that was within HUD's jurisdiction. That is a tough one for me, Mr. Chairman, because on the one hand, I think that there would be some gains from having a more centralized focus on the indoor air problem.

At the same time, I am not sure I feel comfortable in taking on all of the aspects of that issue. But I recognize that as things are structured right now, Congress has given a lot of different agencies a lot of different missions, and we have got to have some way that we can try to coordinate them.

Senator CHAFEE. Do you think we ought to put you in charge, "you" being EPA?

Mr. BARNES. I am not sure what Lee Thomas would say to me if I go back and say I agreed with Senator Chafee that we are going to be the indoor air czar. I may be looking for a new job.

Senator CHAFEE. Typically, what we do is put you in charge and wouldn't give you a nickel more money.

Mr. BARNES. That also would have some down sides to it.

Senator CHAFEE. It is something that we ought to be thinking about.

My next question is this: Are we really seeing goblins under the bed with all this business? When you read the list of things that are possible problems, floor wax, moth crystals, furniture, what are we going to do, just live in some kind of antiseptic room? No, because you can't have antiseptics in there because they emit a gas of some type.

How have Americans survived for so long?

I am not knocking this at all, but I am just curious whether we are spending more and more time chasing infinitesimal things that you get some kind of a reading on when there are not more serious problems out there.

Mr. BARNES. Again, I think that is a fair question, Senator Chafee, and certainly, the problem indoors becomes much more complex than outdoors, because you move in and out of a room that may have been waxed or somebody just had their dry cleaning through and you get exposure from that.

But most of the risk assessment is based on people being exposed over a 70-year lifetime. It becomes very hard to figure out what your cumulative exposures for those short periods of time are and what ought to be done about it.

One thing we think is desirable to do, though, with the work on indoor air, is to at least put these risks in relative perspective so that to the extent we are addressing these risks, we are going after the ones that are the most serious and not necessarily chasing after the ones that are the more minute or infinitesimal risk.

Senator CHAFEE. I do get worried, because I think the public is likely to say, "Forget the whole thing. We can't race around with a gas mask on all day long, and if my furniture is going to pollute me, so be it. I am not throwing my furniture out."

My time is up.

Senator MITCHELL. It was just getting interesting.

Senator LAUTENBERG. I am interested, too. I waive a minute of my time.

Senator MITCHELL. That is such a profound thought I think you should finish it.

Senator CHAFEE. Let me ask you a question. All of us went to schools where, presumably, the piping was insulated with asbestos, and now we are taking asbestos out in all public buildings and in schools.

Is there a clear test? Is there some way of testing to see whether there is a danger of asbestos in building A before it is all stripped out, or is the processed asbestos bad and out it comes? As you know, it is one of the terrible problems in our State. We have had all kinds of problems removing this, and then what do you do when you remove it? It is like disposing of nuclear waste.

Mr. BARNES. Again, I think you have put your finger on a critical question. There are ways of visually inspecting to see whether asbestos is there and whether it is in a friable condition where it is likely to find its way into the ambient air if it is jiggled or poked or so on, and then whether it ought to be removed and encapsulated.

Vic, would you like to respond further?

Vic Kimm heads the office that has the responsibility for asbestos abatement.

Senator CHAFEE. I am over my time, so the answer has to be brief, because I am using Senator Lautenberg's time.

Senator LAUTENBERG. That is all right.

Mr. KIMM. I think in the case of asbestos, where the link to human cancer is among the strongest we have anywhere, a serious concern about asbestos continues. Part of the problem is the latency time between exposure and effect. That is why it is very hard for people to see the connection. In this particular situation and with that particular substance, I think that the scientific linkage is no longer arguable.

Senator CHAFEEE. I don't question that at all. Is any building that has asbestos wrapped around its pipes polluted?

Mr. KIMM. No, and our regulations are set up to try to sort that out into those forms of asbestos that are likely to release fibers into the air.

Mr. EHRETH. Another part of the answer to your question, Senator, is, there are specific methods, methodology analytical tools, to determine the testing, to determine the exposure by examination of building.

Senator MITCHELL. Thank you.

That used up both your time and Senator Lautenberg's time.

Senator LAUTENBERG. There is another kind of indoor air pollution that takes place occasionally in the Senate.

Senator MITCHELL. We will get you on the next round.

We are very pleased to be joined by Senator Lautenberg, who has displayed great leadership in this area and who is the author of much of the legislation dealing with radon and other indoor air problems.

Senator, we welcome you. If you have an opening statement, you can make that and then take your five minutes for questions.

Senator LAUTENBERG. Mr. Chairman, I am pleased to be with you at this hearing and here from these witnesses. I am sorry that I am a little late.

A particular concern for my State, Mr. Barnes—here it is again—is radon exposure, and in our April 2 hearing, Donald Deieso of our New Jersey Department of Environmental Protection testified, and he said that about two-thirds of my State's population may be affected by radon.

He estimated that as many as two million homes could be affected by radon gas, but as the concern over radon increases, it seems to me that EPA's proposed radon budget decreases, and that is unacceptable to me.

Mr. Barnes testified earlier this month that EPA's radon request from OMB far exceeded the amount in the President's 1988 budget. EPA asked for $7.5 million, correct?

You look like you are a little puzzled.

Mr. BARNES. I didn't quite follow the word that you had used in describing how our new request, how it related to the previous ones. I want to make sure I was following your question.

Senator LAUTENBERG. Let's just talk about the 1988 budget. You did say earlier this month that EPA's request for radon involvement exceeded that which the President requested.

Mr. BARNES. That is correct, sir.

Senator LAUTENBERG. EPA asked for $7.5 million and 64 FTE's.

Mr. BARNES. Right.

Senator LAUTENBERG. The Administration cut that to $3.9 million and about 51 full-time people.

That is less, again, than EPA requested, and it is less than you got in 1987. The budget is not only out of line with the problem, it is also out of line with the congressional intent. Senator Mitchell and I labored to add a radon amendment to the Superfund. That put EPA in the lead in radon mitigation.

The Administration responded by chopping EPA's research budget by $1.3 million and expanding DOE—we discussed this before—by $10 million.

With perhaps as many as 20,000 annual cancer deaths attributable to radon a year, we obviously have to spend more, not less. I have joined Senators Mitchell and Chafee in introducing two bills to respond to the radon problem. The radon program, under S. 744, would provide funds to assist States in developing their own radon programs.

The second one, S. 743, directs EPA to conduct statistically significant surveys of schools in each State that might be affected by radon. I recently introduced a third one, S. 756, that clarifies that the mitigation expense can be deducted from income tax as medical expenses.

With these new initiatives and tough oversight of the Superfund radon provision, we can take great strides.

I expect that our witnesses today are going to underscore the need for action in this area, and they will testify about pervasive and serious effects of radon and other indoor pollutants. Mr. Chairman, I am pleased to participate with you in this hearing and commend you for having it.

I would, therefore, like to ask just a couple of questions.

Mr. Barnes, the new Superfund law required EPA to submit a report on the status of its radon demonstration program. That report was due February 1. I raised this with the Agency, raised the question about meeting that deadline in several hearings. We still don't have the report.

When will the Congress have the report, and what is the cause of delay?

Mr. BARNES. Senator, I guess I am stunned to hear the first part of the report had not been delivered to Congress. So if you don't personally have a copy, I will make sure that before the day is over, you do have a copy of it.

Senator LAUTENBERG. The section 118 report.

Mr. BARNES. I am sorry, Senator.

Senator LAUTENBERG. We are talking about the demonstration.

Mr. BARNES. We have several reports.

Senator LAUTENBERG. One is on the research side of things. The other side is on the demonstration side.

Mr. BARNES. The report on the demonstration side, the staff tells me, we will have within two months.

Senator LAUTENBERG. Within two months. Obviously, it suggests that we were unrealistic of picking a February 1 date, 16 months away. What is the problem with producing that report? Don't grimace like that.

Mr. BARNES. If you will excuse me just one minute?

Senator LAUTENBERG. Sure.

[Discussion held off the record.]

Mr. BARNES. Senator Lautenberg, I am going to have to get back to you on that. The advice I am getting isn't going to give me the ability to answer your question in the way that you deserve to have it answered in terms of a full explanation.

Senator LAUTENBERG. If you would, please, submit that for the record so that everyone can see what the problem is there.

[The following responds to Senator Lautenberg's request for additional information:]

The first annual report on EPA's radon mitigation demonstration program, due February 1, 1987, pursuant to section 118(k) of the Superfund Amendments and Reauthorization Act of 1986, has cleared inter-agency review and will shortly be forwarded to the Congress.

Senator LAUTENBERG. I understand that EPA is currently testing for radon exposure in 10 states. Is that true?

Mr. BARNES. Yes, Senator. We are working with 10 States at this point that wanted to do their own surveys for hot spots. We have 14 States another 14 that are waiting to work with us, and three States, including your home State of New Jersey, are doing that on their own. We have consulted with them. But they have stepped up to that task themselves.

Senator LAUTENBERG. What have the first 10 shown about incidents of high level radon exposures?

Mr. BARNES. Mr. Chairman, we don't have all the results back, but essentially, we are finding elevated radon levels in all of those states. In most of them we find some outliers. In most of the states outside the problem ones we haven't found the real strong outliers that we have in the States referred to, but nonetheless, we are finding levels that are elevated over our action level.

Senator LAUTENBERG. How high? Can you tell me, Mr. Barnes? Might some of these levels be above the threshold?

Mr. BARNES. One hundred picocuries per liter.

Senator LAUTENBERG. Restate, just so we remember here, the base level.

Mr. BARNES. Four picocuries per liter is the action level we suggested that if people found exposures there are some steps they could prudently take to reduce exposure.

Senator LAUTENBERG. Additional States have asked EPA to do similar testing. Did you say there are 14 more? How many more States?

Mr. BARNES. There are 14 other States that have asked us to help assist them with those surveys. We took the 10 that were picked on the basis of the States that looked to us to be the most ready to participate with us and use the resources we had to work with them on it. We will, in the next fiscal year, be getting to a number of those additional States.

Senator LAUTENBERG. How many States will you be looking at testing for in 1988?

Mr. BARNES. Mr. Chairman, with respect to the State surveys, it is going to depend on what the final 1988 budget is. I should also add, we anticipate that as we get into the next fiscal year, we will have the canisters in place with respect to the national survey we are doing, which will get us into a broad array of States in our own right.

Senator LAUTENBERG. It does focus, doesn't it, on the inadequacy in the budget to do this job as rapidly as we otherwise might be able to do?

Mr. BARNES. Well, as we discussed last time, there is some relationship between the budget and what we are able to do. Candidly, another problem we are having is owing to the success of the radon measurement proficiency program. Many more companies have come to us and asked us to certify that they are able to accurately test for radon. The resources then get pulled into that program, which isn't self-supporting, and it detracts a little bit from the others.

We talked last time about your consideration that making that program self-supporting might be of some help, and since those people, contractors, are going to get some benefit, I believe that might well make sense.

Senator LAUTENBERG. I think when we are made aware of the fact that radon might be the number one cancer risk in the country, after cigarettes——

Mr. BARNES. After cigarettes.

Senator LAUTENBERG. Cigarette smoking, certainly. Senator Chafee touched on looking for the nits and lice of problems, that are not really major. This is one that has the kind of characteristic that suggests all-out war on the problem. Because we don't see the result of the exposure for such a long period, there is a tendency to not be as alarmed as I think we ought to be.

You confirmed and CDC confirms and every other report confirms that this is a very serious problem in our country. How we can be having the budget battles we have for relatively small dol-

lars when we have a chance to do something to protect human health escapes me.

Thank you, Mr. Chairman.

Senator MITCHELL. Thank you, Senator.

Mr. Barnes, I would like to ask two things of you. The first is that the next panel will be discussing the health effects of indoor air pollution. If you could at least ask someone from your agency to stay, one of the problems we have is we hold these hearings and then people who ought to be hearing most of what is said frequently can't be here.

The second is that, as you know, the Committee rules require witnesses to submit their written statements 48 hours in advance. I know you have a lot to do, and Mr. Thomas has a lot to do, but increasingly, agency spokesmen have been submitting their statements the very last minute, very late the night before, which makes it impossible for us to review those statements in advance and reduces the benefit to all from the hearing.

I would ask if you could, throughout the agency, to the extent possible, consistent with the many other demands upon your time, make an effort to try to submit your statements 48 hours in advance to give us a chance to review them and to be in a position to intelligently and thoughtfully question you?

Mr. BARNES. Mr. Chairman, let me apologize, because certainly, I know the last two times I have testified my statements have not gotten cleared and gotten up here until well after the close of business the day before. We will discuss that problem at the senior staff and make every effort to improve that. It does have the potential to inhibit the kind of discussion we would like to have here.

Senator MITCHELL. Thank you very much, gentlemen. Thank you, as well.

The next panel, which will deal with the health effects of indoor pollutants, are Dr. John Spengler; Dr. Jan Stolwijk; and Dr. Ellen Silbergeld. Could we have those persons come forward, please, so that we can begin with this panel?

STATEMENT OF DR. JAN A.J. STOLWIJK, PROFESSOR AND CHAIRMAN, DEPARTMENT OF EPIDEMIOLOGY AND PUBLIC HEALTH, YALE UNIVERSITY SCHOOL OF MEDICINE

Senator MITCHELL. Good morning, Dr. Silbergeld.

Good morning, Dr. Stolwijk. Apparently Dr. Spengler is not yet here. Why don't we begin with you, Dr. Stolwijk. According to the agenda, you are the Chairman of the Department of the Epidemiology and Public Health at the Yale University School of Medicine.

Doctor, we welcome you. We look forward to hearing your testimony.

Dr. STOLWIJK. Thank you, Mr. Chairman.

Mr. Chairman and members of the committee, it is a privilege for me to be allowed to appear before you to gather facts and views about indoor air pollution. It is the very success of the Clean Air Act amendments of 1970 in improving the quality of the outdoor air which has caused us to focus more on the contribution made by the indoor environment to the total exposure of our nation to the contaminants in the air we breathe.

The quality of the outdoor air is critical to the quality of the indoor air, as well. Indoor air is in constant communication with outdoor air, and, in fact, we rely on the ventilation of outdoor air to maintain an acceptable indoor air quality.

Effectively, the highest indoor air quality that we can achieve is the quality of the outdoor air that surrounds the building. The American Society of Heating, Refrigerating and Air Conditioning Engineers in its project on setting a standard which is currently underway and which guides most of our building codes, noted that we can now effectively count on having outdoor air available of acceptable quality in virtually all jurisdictions.

This is one measure of what all of us owe to the efforts of your committee.

The Agency's awareness and concern about indoor air pollutants is not due to a rapidly deteriorating or crisis condition, but it is due to an increasing recognition of exposures which have always been there.

This is a significant thing to remember. Due to the improvement in the outdoor air quality, the relative proportion of the sources and indoor spaces contributing to the total population exposure has increased substantially in the last 15 years. The absolute level of indoor exposures has increased a small amount, and it is likely that some changes in the sources have taken place as new technologies and new products were developed.

But there has not been a serious increase in the absolute level. The levels are not detected that people have become aware of that have always been there. Most pollutants we now breathe in are, in fact, breathed in indoors.

A further reduction in the total exposure of the population to air pollutants is very feasible and should be pursued. This reduction cannot easily or effectively be obtained by further improvement in the outdoor air quality, but substantial reductions in total population exposure can be obtained by improving the quality of the air in indoor environments.

Pollutants in the outdoor air could be reduced by the action of Federal and State government regulation which brought this about. Pollutants in the indoor air can be reduced and removed only with people, with the assistance of research required to properly inform and educate people and to develop methodologies for pollutant reduction.

But the cooperation and assistance of a large number of mostly private participants is also required to reduce the number or the strength of sources, to improve ventilation and other practices in the operations of buildings, et cetera.

A lot of very valid questions are being asked about what we know and what the quantity and the quality is of the knowledge that exists. A great deal of knowledge already exists about the type and concentration of air pollutants in the indoor atmosphere, and some have even produced distributions of these concentrations among the millions of spaces which people occupy.

This knowledge has not yet been assembled in a manner which is necessary to make clear statements about this distribution. It is necessary to collect this knowledge in a consistent manner so that

we can identify where we already know enough; where we should collect additional data; and what data we should collect.

Similarly, a great deal of relatively qualitative data exists about the indoor health consequences of the exposure of indoor air pollutants. But in many cases, the quantitative relationships have not yet been established. The collection and evaluation of the existing knowledge in this area to arrive at a consensus of what is known in a quantitative matter will also identify areas where qualitative research is most needed.

Priorities for research should be based on both the expected public health impacts of a given exposure or pollutant as well as on the existing level of the quantitative knowledge that we can count on.

Inside, about the distribution of severity of exposures and the impact of public health, information needs to be in a form which can inform building occupants and owners and to bring about the changes necessary to reduce exposures. This is different from the form of knowledge which is needed to support legislative and regulatory activity. The written statement which has been provided to your committee staff gives examples about the type of data collection and analysis which might be the most helpful format.

I would like to draw your attention to one increasingly important area where probably the situation is deteriorating, and that is the air quality in public access buildings such as offices, schools, et cetera.

There are many possible causes which conspire to reduce the air quality in such buildings below levels acceptable to the occupants. Some of these are structural and organizational; and some of these are technical.

The total prevalence of these conditions is not well known, but it is expected to be substantial. We believe that it clearly has a serious effect on the feeling of well being on the occupants and has a serious effect on the productivity of workers in such sectors. As our society increasingly converts to service employment, the indoor pollution problem may have very sericus impacts on national productivity.

I have in the written statement some mention of the activities of the Environmental Protection Agency as a lead agency and its responses to the various Congressional initiatives, and I might conclude by saying that I believe that the Administrator and his immediate staff have responded with the proper urgency and we are awaiting the implementation of some of the plans that they have outlined earlier at the hearing.

I would like to conclude by again expressing my appreciation to the Chairman and the Committee for the opportunity to make a statement. Thank you.

Senator MITCHELL. Thank you, Dr. Stolwijk.

Dr. Silbergeld, you are the Senior Toxicologist at the Environmental Defense Fund. You have been before this Committee before. We have always benefitted from your testimony, and we look forward to hearing from you again today.

Dr. SILBERGELD. Thank you very much, and thank you for permitting me to speak without having had the time to get you my testimony beforehand. It will be arriving before the end of the day.

Senator MITCHELL. Do better than the EPA next time.
Dr. SILBERGELD. We hope to emulate the EPA.
Senator MITCHELL. Don't go that far.

STATEMENT OF DR. ELLEN SILBERGELD, SENIOR TOXICOLOGIST, ENVIRONMENTAL DEFENSE FUND

Dr. SILBERGELD. You know, there is a very striking image, I think from an Isaac Asimov story of a world destroyed by misuse of chemicals in which people are driven to living inside surrounded by contained breathing apparatuses. Perhaps we have reason to question whether, in fact, that drastic environment may save us from our abuse of the chemicals that give us so much.

I want to talk today not only on behalf of the Environmental Defense Fund, but also on my experience of serving on the Board of Environmental Sciences and Toxicology of the National Academy of Sciences, which, as you know, has produced a number of reports in this area, most recently, a report of epidemiology in air pollution in 1985.

We believe that exposures to substances in the indoor environment, including vehicles of transportation, offices, businesses, shopping malls, schools and homes, constitute very significant risks to human health.

While this is increasingly acknowledged, we believe that current responses to many particular problems identified in the indoor environment have been misguided and consequently, ineffective. Too often, we see that a new environmental issue, once identified, is manipulated as a means, frankly, of trashing concerns raised over other issues. Nowhere is this negative process more common and more deleterious to our common of goal of health promotion than in air issues.

The indoor environment is basically defined as the environment within a structure and that gives rise to the two most critical factors related to human health impacts. One is, as Dr. Stolwijk described, the reduction in air exchange, which results in the structures serving essentially as traps. That is, pollutants enter them from the outside at a given rate, but they leave at a much slower rate. Thus, in most cases, indoor air will almost always have more contaminants than outdoor air.

In case of particulates, those may fall out within the indoor environment, and they then will be accumulated and remain as sources and vectors of exposure. Indoor air quality is also affected, as you have noted, by sources internal to it; that is, materials contained in building products and in consumer products that are used particularly within the indoor environment.

Certain practices that are limited to the indoors, such as heating with wood stoves, cooking with gas or treating wooden homes with termiticides, produce significant benefits and significant health problems because of trapping inside and human use phenomena.

Radon is probably the best demonstration of the trapping phenomenon. As you know, radon exists ubiquitously outside in the earth. That is, it is not created by American homes as they are built and designed, but it is inside our homes that radon gas is prevented from its ready diffusion and dilution. Inside structures, it

accumulates to the dangerous levels, which, as you have noted, threaten the health of potentially millions of Americans.

In addition, particulates, as I mentioned before, can be trapped in homes, resulting in demonstrable health effects.

For example, in Philadelphia, in homes near the National lead industry smelter, lead in house dusts has been measured in concentrations up to 2,000 parts per million.

To put that in a health perspective, demonstrable health effects have been found in women and children exposed to soils and dusts contaminated with lead at concentrations of 100 to 200 parts per million or 10 to 20 times lower than this extraordinary indoor measurement.

I think the examples that you have cited and others have cited today should indicate that the toxic substances found in indoor air are very dangerous, and the health impacts are likely to be substantial. Radon, asbestos, and, at last, formaldehyde, are all recognized by the EPA as human carcinogens. Lead is a well known cause of human disease.

Other substances, which are accepted as risks in the outdoor air—volatile organics, other metals, polycyclic aromatic hydrocarbons—for many reasons are incrementally more risky simply because of the attenuation of their dispersion in the indoors. But the real significance of indoor air pollution as a factor of human health relates to exposure.

As you have noted, we now spend a great deal of our time inside houses. In fact, we now exercise inside, increasing our ventilation rate and subsequent exposure.

This new pattern of American behavior is not reflected in current approaches to exposure assessment at the EPA.

I would like now to talk about, to refer to one more disturbing indicator of the impact of indoor air pollution, which I believe others will describe in detail, and that is the hundreds of incidents which NIOSH and others have investigated related to the so-called "sick building syndrome".

The health effects of indoor air quality, Mr. Chairman, go far beyond the incremental risks of cancer and the neurotoxic effects of lead. The disabling conditions involving irritation, sensitization, nausea and subtle neurotoxic symptoms associated with the so-called sick building syndrome affect millions of workers. The reduced air exchange common to these so-called sick buildings points to indoor air pollution as the common source of its likely problems.

I won't speak to the specific needs that we have and the research, because I think Dr. Stolwijk has covered that, but I would like to talk about solutions available to us at the present time, if I may.

While research is clearly needed, as noted by EPA and others, there are major actions which can be taken now to improve both regulatory oversight and integration of response to specific indoor air pollutants. First and most important, in a policy sense, we must expand our concept of ambient air to be consistent with the operational meaning of the phrase ambient, which is, where people are—not outdoors, not indoors, not some specified environment.

We believe that there is no legal barrier in the Clean Air Act to your oversight and your encouragement of action by the appropri-

ate agencies to include both indoor and outdoor air in the concept and legal responsibility for ambient air quality.

Second, it is important to recognize the nature and sources of indoor air pollutants in order to guide rational and expeditious action to reduce the potential health effects. As you know, indoor air pollution can result from three major sources: the outdoor air; geologic releases from the earth's crust, such as radon; and releases from consumer products, including building materials.

If we identify these sources clearly, it may assist us in decision making. When we consider outdoor air, Dr. Stolwijk has said, as the primary source of indoor air, it then makes no sense to play indoor air pollution concerns off against outdoor air issues, as EPA is prone to do, for example, in their recent publication, "Unfinished Business."

For many pollutants, indoor air is only the proximate source of exposure. Outdoor air is the ultimate source. And in these cases, control of inputs into the outdoor air is the most effective way to reduce contamination of indoor air. There is no barrier in the establishment of ambient air quality standards to the consideration of exposures in the indoor environment in setting those national ambient air quality standards, Mr. Chairman.

With respect to geologic releases, I think what Senator Lautenberg and others have described is a program that requires recognition of a national emergency on the scale of a hurricane or a disastrous flood. We need to mobilize the resources we have; overcome petty divisions, state and national differences of priority; and allocate the money that we would allocate if we considered this a natural disaster, which I submit to you it is.

Finally, we consider that probably the single most significant set of sources for indoor air quality degradation and known health impacts relates to consumer products. Insufficient attention is currently paid to estimating exposures within indoor environments when such products are evaluated, either as new chemicals or as existing chemicals under the Toxic Substances Control Act.

Obviously, better integration between EPA and other regulatory agencies are needed, not a gathering of 16 agencies among which things will readily fall into the cracks.

Although we have some hope that EPA is reviewing its responsibilities and perhaps injecting some vigor into the Office of Toxic Substances, the recent decisions to hand off responsibility on such major indoor pollutants as methylene chloride and ethylene glycol questions the ability of this Agency to take charge of the consumer product source.

In summary, we strongly commend you for your concern over indoor air pollution. We believe, as you do, that some of the most serious health effects of toxic substances result from exposures to them in indoor air. However, concerns over indoor air quality cannot supplant or compete with concerns over ambient air quality or the other major goals of the Clean Air Act.

A systematic understanding of the indoor air pollution problem will best guide us to risk reduction, and this analysis indicates that ambient outdoor air, natural geologic leases and consumer products are the most important sources of indoor air pollutants. Indoor air exposure is largely neglected in regulatory decision-making. It can

be integrated into specific statutes, but specific statutory encouragement may be required.

Research is most critically needed in the area of exposure assessment and in understanding how building design and product design lead to impacts on indoor air quality. Research, especially epidemiologic studies, is grossly underfunded.

Finally, we believe that active use of TSCA, for its intended purposes as prevention, is the most appropriate way to provide for control of products which are likely to contribute to indoor air pollution.

Thank you, sir.

Senator MITCHELL. We will say that you used Dr. Spengler's time.

As always, Dr. Silbergeld, that was a very thoughtful and compelling statement. Is it fair for us to conclude that your answer to the question that Senator Chafee and I and many others have posed as to whether or not this is a serious problem to which we must devote concern, and it does threaten the health of Americans, and that we are not just chasing an unimportant fancy, is it fair to conclude that is your position?

Dr. SILBERGELD. That certainly is our position. I think when we look at such substances as asbestos, radon, lead and formaldehyde alone these demonstrate dangers to human health. The primary exposures for our population are, indeed, through the indoor environment.

I would like to emphasize that the phenomenon that we are finally beginning to recognize is not psychosomatic, that is, the sick building syndrome, is not one of those kinds of health effects with the long latencies and the very severe consequences that we normally look at when we look at air pollutants. It is a very real and major threat to health.

I think the whole area of immunologic and neurotoxic effects is going to be of increasing importance when we assess what exactly is the health status of our population and how do environmental changes effect that status? This is a key example. We could do much worse than guiding considerable research on this particular public health phenomenon.

Senator MITCHELL. Dr. Stolwijk, do you agree with the conclusion expressed by Dr. Silbergeld regarding the nature of the threat and the extent to which we should be concerned about it?

Mr. STOLWIJK. Yes, I do, sir. The total public health impact of avoidable exposures indoors which, as I pointed out, have been occurring right along but haven't been recognized to the extent they now are, but the total public impact, if we ever got the total health impact properly, which we would be able to do if the exposures are better characterized, if the qualitative relationships between exposure and effects are properly recognized, that total public health impact of avoidability would be very substantial.

There is, for instance, reason to believe that a good deal of lower respiratory illness, infectious illness, of various types, acute infectious illness, is actually associated with exposure to indoor air pollutants. A large number of avoidable illnesses occur, probably measured in millions in the U. S. population, that could be avoided.

Senator MITCHELL. One of the questions we must answer if we respond affirmatively to the threshold question, that is, if we accept your view and it is a serious problem, is that we approach indoor air on a comprehensive basis or on a pollutant-by-pollutant basis.

My question is: Are there advantages to a more comprehensive approach? For example, are mitigation measures common to more than one pollutant? Or should we approach it specifically taking each pollutant at a time and attempting to establish a standard or in some other form reducing the threat of that pollutant?

Dr. Silbergeld, would you comment on that, and then I will ask you also, Dr. Stolwijk, to comment on that.

Dr. SILBERGELD. I think that is a very critical question, not only here, but, in fact, in the whole way we approach environmental issues. I think the answer is both. Certainly, we need to stop this collision course between objectives in building design, for instance, to reduce energy use, and objectives to preserve a healthful indoor environment, and there are steps being taken within professional societies to do that.

So that there are, yes, in fact, generic design questions and approaches that we can take looking at the air as a physical entity that we should preserve. But when we came to look at some of the specific sources, obviously, I think we then have to look at chemical-by-chemical support, or at least source-by-source concerns.

For example, what will help in dealing with radon will not help with dealing with something that might repeat the formaldehyde history, in which we allowed a product to be used in enormous amounts which readily allowed chemicals to be released in indoor environments.

So I think there are categories in responses that may help us more clearly.

Senator MITCHELL. Dr. Stolwijk.

Dr. STOLWIJK. I agree with Dr. Silbergeld that, in fact, it is a combination of the two kinds of approaches. In very large buildings, it is clear that the effectiveness of the ventilation is a very major determinant of what happens in that building, but in addition to that, if the introduction of generic sources of pollutant can be avoided, tobacco smoke being a very important one, certain solvents being other important ones, that can help a building.

It is a combination of the two approaches that is really needed. The derivation of precise standards for a large number of chemicals or for proper information systems that leads to the introduction of a very large number of simultaneous pollutants that are each numerically expressed is probably going to be somewhat counterproductive.

I think the advice to avoid certain types of products that contain certain classes of chemicals is probably going to be much more effective than to tell an individual household about the particular levels of a large number of chemicals that might be in a home or that might or might not be there.

That would be a confusing statement that I think is not going to be very helpful in the overall reduction of the population exposure. A more comprehensive approach, such as you suggested, I think, is the way to go.

The regulatory type of approach that would prescribe this concentration of one chemical, another concentration of another chemical and so forth, in the household and in the very many millions of indoor spaces, is a large step.

Senator MITCHELL. Thank you very much, Dr. Stolwijk.

Senator Chafee?

Senator CHAFEE. Thank you very much, Mr. Chairman. Let me touch on a couple of conclusions that I have drawn from both your testimonies. First, that indoor air constitutes a greater risk than outdoor air. Certainly, you said that, Dr. Stolwijk. That doesn't mean that we shouldn't do everything we can to continue to clean that outdoor air, but indoor air constitutes the greatest threat.

There are certain obvious indoor air contaminants such as tobacco and radon. When we get beyond those, however, there are a series of pollutants that you discussed such as formaldehyde or the treatments on woods.

What can the average citizen do about those? I am going to buy a house. I am a nonsmoker, and I am smart enough apparently, let's assume, to have a test to determine that this house has no radon. What else can I do? How can I determine that there is no formaldehyde fumes or contaminants?

What does the average citizen do about these things?

Dr. SILBERGELD. After the fact that it is very hard, I would like to relate that in the Environmental Defense Fund, when we remodeled our new offices in New York, we specifically asked for assistance in this area, and we exercised as much control as we could over the selection of desk materials, rugs, paints, lighting and any physical entity that was going to go into that building, as well, of course, as the ventilation system, in order to minimize this.

I don't think this is something that citizens can really deal with. If you look at a house and someone made the mistake of using a great deal of asbestos in the basement, and I would like to return to your question about the present risks of asbestos in its various forms, if I might, sir, or use of formaldehyde for insulation, there is very little you can do except to continually shop around.

I don't know; do you want to declare whole housing developments virtual Love Canals because of the way they were built and the way they were stocked with products? It seems to me that is an extraordinary waste of a national resource for a country that has a lot of homeless people. It seems to me we have got to go to the root of the problem, as in the asbestos approach which Congress has finally persuaded the Ageney to adopt, which is to look into the entrance of the material into the product lifestream because of its risk, particularly in the indoor environment, is the kind of preventive measure that all of us in public life are trying to take.

With certain specific high-risk environments, we might, in fact, go further. The National Academy of Sciences Committee is considering a very extreme environment, which is the airplane cabin, and has recommended two steps to be taken immediately: A ban on all smoking in airplanes, and a prevention of holding people within airplane cabins for periods longer than necessary for the flight. For those of us who fly in and out of National Airport, we know what that means.

Those are the kinds of behavioral steps that we might have to look to in order to remediate buildings that we have damaged by our failure to prevent at the level of product regulation.

Senator CHAFEE. Dr. Stolwijk said that these pollutants have always been there. But I would assume that the toxicity of the pollutants is far greater now than it was 30 years ago. I can't believe that we don't have a much more virulent form of moth killer around than formerly was there. Is that true?

Dr. STOLWIJK. That is true, Senator Chafee. The amount of radon that is in indoor environments now was there 30 years ago, also. The amount of tobacco smoke that you find in either environments was there 30 years ago, also. The amount of formaldehyde that you now find in indoor environments is higher than it was 30 years ago. The amount of pesticides that you will find in an environment is higher than it was 30 years ago.

It defies the very great generalizations that we all like to make that some of these dangers were there before. Some new ones have been introduced. Until we have, as we have urged the Environmental Protection Agency to do, until we have some kind of assessment that puts these things in perspective, it is not possible to say how much of this or how much of that we should accept.

I think that is a very high urgency and very urgent thing to get into, and I think that we have a right to have the Environmental Protection Agency do this for us.

Senator CHAFEE. It must be a synergetic effect in that if you have a gas stove and that is the only thing you have of that nature that is one thing, but if you have a gas stove and you have formaldehyde and you have tobacco smoke, they may all work together.

What worries me is that I recognize these things, and we ought to do something; we are trying to help the average person out there do something. Do you believe that naugahyde furniture should have a label on it that this emits x, whatever the unit of measurement is, into a room and add that up when you are considering what you are doing to your apartment?

Dr. STOLWIJK. I think what action we might take is that if you have that kind of furniture, that you might find that you have to have more ventilation than you otherwise would have had. You have to open the window more than you otherwise would have. It doesn't mean you have to get rid of your favorite chair, but it probably does indicate that you should avoid, in a house that contains many of these sources, to avoid as much as possible the complete closing off of all ventilation.

Senator CHAFEE. I think you mentioned in your testimony that opening the windows is, as simple though it may seem, is a preventive measurement one can take.

Dr. STOLWIJK. That is right.

Senator MITCHELL. Why don't you just proceed, Senator.

Senator CHAFEE. You were going to say something, Dr. Silbergeld?

Dr. SILBERGELD. Yes. I think the other major change that has occurred is behavioral. We have changes in consumer products, and I think the materials in our homes are more likely to be synthetic in origin than they were 30 and 50 years ago. In our schools, when I went to school, there was asbestos in the school, but perhaps when

people were in school 40 or 50 years ago, there wasn't as likely to be asbestos in the school because the idea of sprayed asbestos and using asbestos to reduce noise hadn't quite caught on back then.

The real change has been our behavioral changes. We now spend, as the Chairman noted, a considerable fraction of our time indoors. That is new, and we have also changed our building designs for a variety of architectural, asthetic and energy conservation reasons. That is also new, so if you add up the existing problems, the new consumer products and the changes in behavior and building design, I think we are confronted with a situation of increased exposure, increased risk and increased disease related to the specific environment, sir.

Senator CHAFEE. Fine.

Thank you, Mr. Chairman.

Senator MITCHELL. Thank you.

We are pleased that Dr. Spengler has been able to join us. Unfortunately, Dr. Silbergeld already used up all your time.

Since you made the effort, I think we should hear from you. Dr. Spengler is the Professor of Environmental Health at the School of Public Health at Harvard University.

Doctor, welcome. We look forward to your testimony.

STATEMENT OF DR. JOHN D. SPENGLER, PROFESSOR OF ENVIRONMENTAL HEALTH, HARVARD UNIVERSITY

Dr. SPENGLER. Thank you. I share a podium here with some esteemed colleagues, and I am sure they have covered a number of these areas. In the interest of time, hopefully, I won't be redundant.

I will skip through my prepared testimony and hit some highlights. First of all, we have been involved in air pollution health research for a number of years. This has involved exposure assessment. In particular, we have investigated indoor air pollution in homes; arenas; transportation facilities. It is quite clear that where there are indoor sources, the exposures are dominated by those concentrations that people encounter indoors. That is not to say we shouldn't be concerned about outdoor air pollution. We still have pollutants such as ozone, acid aerosols that are predominantly outdoors. We have to pay attention to these exposures.

To try to assess the seriousness of the threat, indeed, there is evidence that deaths do occur from indoor air pollutants. I think most notably it is carbon monoxide poisoning that does account for a number of deaths in the United States and throughout the world that occur fairly regularly on an annual basis. Even extrapolating from the recent evidence about passive smoke exposures and increased respiratory illness in children, it seems to me there are substantial medical costs, lost wages, lost school time, that can be expected from even these subtle low level exposures that are encountered in our homes and office buildings.

Even if only a small percentage of the nation's mortality rate for cancer, which is about 350,000 cancer deaths per year, were attributed to radon, passive cigarette smoking, formaldehyde or orgonic vapors, it would exceed the risk from any other single man-made cause including routinely operating nuclear radiation.

I think it is clear that these common exposures occurring in homes and office buildings are attributing to mortalities in the United States.

Let me skip forward to discuss what I think are some of the serious issues. I am sure Dr. Stolwijk and others have mentioned radon and passive cigarette smoke and materials such as pesticides, cleaning compounds, solvents and disinfectants which give raise to volatile organics.

I think the issue I would like to raise is that we now have some evidence that these organic exposures indoors to compounds that are known or suspected carcinogens can yield a calculated risk to individuals living in those environments that is higher than the risks now associated with many hazardous waste sites that are undergoing tremendous expenditures for clean-up.

I believe that exposure commitment needs to be incorporated into our regulatory and research disease-making.

I wanted to say a word about asbestos. Asbestos in building insulation directed materials has the potential of becoming friable and producing airborne fibers. Often, friable conditicns can be easily detected.

Today, EPA's asbestos program has de-emphasized reliance on air measurements. As a result, there has been an irrational response of removing asbestos from schools and buildings based completely on its presence. In most cases, actual exposures to asbestos fibers has not been documented. I contend that possibly and potentially, more harmful removal of asbestos has been undertaken irresponsibly.

On the other hand, asbestos in plaster and pipes and furnace insulations was widely used in homes. Replacement of boilers damaging and aging pipe insulation is far more likely to cause asbestos exposures in homes, yet exposures to asbestos in homes is still inadequately studied and could represent a real risk.

I have offered in my testimony what I feel are some of the important areas of research that has yet to be done. In response to, I think, a question from Senator Chafee about the pollutants interactions. I think it is clear that radon and cigarette smoke or particles in the air are very likely to have a stronger interactive effort, and thereby, delivering the dose to sensitive tissue. These kinds of interactions are not yet fully understood and are certainly worthy of investigation.

I think we are going to see in this country, as the Europeans have indicated, that there is a replacement of asbestos and fiberglass with manmade mineral fibers. The irritants effects and potentially the health effects of manmade mineral fibers have yet to be investigated adequately.

In conclusion, I remain optimistic that EPA will accord indoor Air Quality high research visibility that is required. Substantial problems await Congressional resolve to establish leadership and establish priorities based on rational understanding of exposures and effects rather than the chemophobic fears of the public.

Senator MITCHELL. Thank you, Dr. Spengler. The threshold question that has arisen when asked of these and other witnesses by myself and Senator Chafee, your remarks indicate what your response would be, but I want to ask it.

Is this a serious health problem to the American people to which the Congress should devote attention and concern, or should we be looking at other things that are more serious and regard this as either frivilous or, if not frivilous, then at least not sufficiently relevant to justify attention and resources?

Dr. SPENGLER. To answer that, I think one looks at what is happening today. I think today, a lot of resources are being expended on items and exposures that are frivilous or de minimus in terms of the potential serious effects.

On the other hand, then not enough attention is being paid to or in development of good policy on pollutants or contaminants for which we really are beginning to see where the real exposures are coming from.

This is the difficult thing about indoor air. A lot of these problems are subtle, they are diffuse. They are spread across society, so the ascertainment of the quantifiable effects are difficult to obtain. Nevertheless, if you take just one pollutant, such as passive cigarette smoke, where well over 50 percent of the children in the United States are being exposed on a routine, daily basis, and combine that with the health evidence that is emerging in that area, you would have enough evidence to say, "Look, we are paying a very substantial price, and not just on the health care, but on lost work days and lost school days."

I think that easily justifies expenditure in this area. One can go on and name a number of the other materials, too, but I am pretty sure they have been mentioned.

Senator MITCHELL. Thank you very much, Dr. Spengler.

We are pleased to be joined by Senator Pressler. Senator, this panel has just completed its statements and responses to questions. Before I ask them to step down, do you have any questions of this panel that you would like to ask?

OPENING STATEMENT OF HON. LARRY PRESSLER, U.S. SENATOR FROM THE STATE OF SOUTH DAKOTA

Senator PRESSLER. Thank you, Mr. Chairman. I have an opening statement which I will place in the record, and I thank you very much. I apologize for being late. I am on three committees going this morning.

[Senator Pressler's statement follows:]

OPENING STATEMENT OF HON LARRY PRESSLER, U.S. SENATOR FROM THE STATE OF SOUTH DAKOTA

Mr. Chairman, I commend the chairman for scheduling this important hearing on indoor air pollution. We must recognize that air pollution problems are not limited to large cities or the outdoors. Air pollutants cannot be completely excluded from offices and homes. Certain substances also create unique pollution problems in homes, schools and other buildings.

I was very troubled by a recent article in the Washington Post on the adverse health effects of chemicals used to control termites. The article told of people being forced from their homes as a result of the contamination from these chemicals. The residue from various pesticides or rodenticides used in homes should be carefully examined.

There are many other sources of indoor air pollutants which we must examine. Radon, asbestos and cigarette smoke have received a substantial amount of attention. We should not limit our action to these areas.

Mr. Chairman, I look forward to hearing the testimony of the experts we have here today.

Senator MITCHELL. I notice a vote is occurring. Have you voted?

Senator PRESSLER. I have not voted. The bells were going off as I was walking over here.

Senator MITCHELL. Thank you. I will then ask this panel to step down and thank you very much. Your testimony has been valuable, informative, and will be helpful to the Committee.

To the next panel I will say that a vote has begun just a few moments ago. I am going to leave and go vote.

Senator PRESSLER. Do you want me to chair the hearing?

Senator MITCHELL. Please.

Senator PRESSLER. Fine. Seven minutes?

Senator MITCHELL. I will ask the next panel to come forward. Senator Pressler will preside while I go and vote, and I will be back as soon as I can.

One of the witnesses is Mr. Philip Merrill, Executive Director of the Maine State Employees Association. Welcome, Mr. Merrill.

Senator PRESSLER [presiding]. While the panel is being seated, I might read a portion of my opening statement. I commend the Chairman for the scheduling of this important hearing on indoor air pollution. We must recognize that air pollution problems are not limited to large cities or outdoors. Air pollutants cannot be completely excluded from offices and homes.

Certain substances also create unique pollution problems in homes, schools and other buildings. I was very troubled by a recent article in the Washington Post on the adverse health effects of chemicals used to control termites.

The article told of people being forced from their homes as result of contamination from these chemicals. The pesticides or rodenticides used in the homes should be carefully examined. There are many other sources of indoor air pollutants we must examine. Radon, asbestos, and cigarette smoke have received a substantial amount of attention. We should not limit our action to these areas.

Who would like to volunteer to be first in this panel?

Dr. Godar, would you like to go first?

STATEMENT OF DR. THOMAS GODAR, PRESIDENT-ELECT, AMERICAN LUNG ASSOCIATION

Dr. GODAR. Thank you very much. Members of the Subcommittee. I am Dr. Thomas Godar, Director of the Pulmonary Disease Section at St. Francis Hospital in Hartford and on the faculty of both the University of Connecticut School of Medicine and Yale University in Connecticut.

I am currently President-Elect Designee of the American Lung Association. I am here, frankly, as a practitioner. I notice I am the only practitioner of medicine with a doctor's title here today. I am going to present comments on behalf of the American Lung Association, which has, for a long time, been involved in the fight to produce clean air.

We have recognized as an organization, including the American Thoracic Society, our medical and research arm, that both indoor and outdoor air pollution are major problems. We have been implementing programs to provide clean air or to return our air to a clean state since as early as 1966.

We are increasingly aware that because of our previous concern, primarily with outdoor air pollution, there might be a tendency to overlook the major concentration effects for some pollutants indoors and the fact that more of our constituency, our patients with lung disease, the young individuals, the elderly, those who are more sensitive are, in fact, spending increasing amounts of time indoors.

It is estimated the average person spends 75 to 90 percent of their time indoors, and as a matter of fact, with the very young and the elderly, it is probably close to 100 percent. As a consequence, the indoor pollution problem is even more important than it might otherwise have been.

In addition, we have an ever-burgeoning list of consumer products being released indoors. We have an increasing list of materials used in buildings, and therefore, we have, in addition, the constant energy conservation programs and a failure to change our methods of building constructing and maintaining buildings. Such buildings are, in fact, concentrators of pollutants and some of our patients and some of the general public who do not have recognized disease are nevertheless being affected by concentrations of pollution indoors.

The sensitive population continues to be infants, young children, pregnant women, the elderly, and all of the large list of patients with lung and cardiac disease.

I will not go through the list of agents that are recognized to be major polluters, because they have already been mentioned a number of times. But I would simply indicate that it interests me as a clinician, obtaining histories from people working in apparently clean office buildings, that their symptoms are definitely related to the work environment.

We are not talking about an industrial environment; we are talking about what appears to be a clean office building environment, in some cases, our very schools. It is intriguing to me that when I remove them from that environment, their symptoms clear, and as I return them to the environment, doing what little control experiment I can, their symptoms return.

The individuals, as has been alluded to before, are often regarded as hysterical, perhaps even neurotic, because of the strange nature of their symptoms and the lack of objective findings.

In most cases, I can describe the building in which they work, to their amazement, as one that has been modified, renovated, with reduced air exchange; with many partial partitions; with a lot of artificial materials, wall-to-wall carpet; a variety of copiers and very confined spaces.

Senator PRESSLER. Could you repeat that?

Dr. GODAR. Copiers and Xerox machines and the like. Some offices using carbonless copy paper.

Senator PRESSLER. How do they contribute to pollution, the copiers.

Dr. GODAR. From the chemicals, for example, formaldehyde. In one case, there are several major hospitals in the Hartford area. I can tell you there isn't a one that has not had a "sick building syndrome" within its own facilities. That is very disturbing.

Senator PRESSLER. Sick building syndrome?

Dr. GODAR. The sick building syndrome meaning irritation of the eyes, sore throat, cough, in some cases, wheeze, and a variety of upper respiratory symptoms. People suffer an extensive loss of time from work and ultimately, an economic burden.

Asbestos fibers are a concern. Carbon monoxide is a concern, particularly with building designed with garages underneath, particularly in those areas where extensive smoking is permitted with what is now reduced air exchange rates compared to previous decades. We have homes in which there is not only tobacco smoke, but pesticides and a variety of chemicals.

The average storage closet for chemicals contains at least 20 different chemicals being used. Usually, the user does not know the exact nature.

It has been estimated that about 84 percent of households have pesticides and that some 4 to 5 percent of the users have had toxic reactions, sometimes occurring as transients, not reported and not very well documented.

The American Lung Association believes that there are some options for Federal control, and one is that there seems to be no single Federal agency that has been given the jurisdiction for ensuring healthy air, at least in the non-industrial workplace, particularly in the non-work place, the indoor environment, of the home.

A range of Federal agencies have partial authority. EPA, under the Toxic Substances Control Act, can at least control and limit the manufacture of hazardous chemicals and is also responsible for radiation, as we have heard.

OSHA is responsible for ensuring a healthful work place, but this does not include public access buildings, schools, the average office building, and certainly not the home.

The Department of Energy is responsible for energy conservation in homes, but basically, addresses energy conservation rather than the consequences.

The Consumer Product Safety Commission evaluates health and safety of consumer products, but this does not extend to the effects that they produce in the form of indoor air pollution.

There are interagency committees, as we have heard, that include all of these agencies working under EPA as the chair which can work in a coordinated effort and certainly, it would take coordinated effort to control indoor air pollution. The primary obstacles to Federal action to control indoor air pollution is this lack of clear regulatory authority.

The American Lung Association strongly recommends that Congress give clear regulatory authority to EPA to ensure healthful indoor air quality. We recommend amendment to the Clean Air Act to clearly give clean air authority to the agency, for the control of air pollution in both outdoor and indoor environments.

We would not recommend that the evaluation of indoor pollutants be done on a pollutant-by-pollutant basis, perhaps with the exception of radon. As has already been pointed out, this would probably be counterproductive.

We consider that the EPA's authority should address indoor air pollution in schools, public access buildings, office buildings and all work places not currently covered by OSHA.

We believe that the process or standards for indoor air pollution should establish air quality standards and should be similar to the outdoor ambient air quality standard pattern, the principal being development on a health basis with an adequate margin of safety, and protecting even the sensitive population.

Technology-based strategies for meeting the standard should be used, including product standards, ventilation standards, building code standards, and, of course, a major element would have to be public education. Institutional questions will have to be resolved, but we feel the indoor air pollution problem is pervasive. As a practitioner I find it an increasing problem within my own medical practice.

I think the approach should be total rather than pollutant-by-pollutant in terms of how EPA approaches the solution. The American Lung Association is in a prime position to help with public education.

There are many examples in which the solution could be approached by a number of directions, including early modifications in construction and the reduction of smoking indoors.

Senator PRESSLER. I am going to have to interrupt. I have to go vote. Senator Mitchell will be back shortly, so if the panel would just hold fast for just a few minutes.

[Recess.]

Senator MITCHELL. I apologize for the inconvenience, ladies and gentlemen.

Dr. Godar, I understand you had just about concluded your remarks. Did you have any final comment you would like to make, and we will proceed to the next witness?

Dr. GODAR. Yes. Since I represent, at least indirectly, the research arm of the American Thoracic Society, I must comment that the American Lung and the American Thoracic Society feel strongly that much more resources should be put into research into indoor air pollution.

If we have a lack of data base in the outdoor pollution health effects, it certainly is as much the case in the indoor air pollution, health effects. As I stated before, ALA feels that EPA should be the agency that takes control and coordinates the effort in controlling indoor air pollution.

Thank you.

Senator MITCHELL. Thank you. Then we will proceed with Mr. Phil Merrill, who is the Executive Director of the Maine State Employees Association.

Mr. Merrill is a long time personal friend of mine and very outstanding former public official in Maine and now, as I indicated earlier, the Executive Director of the Maine State Employees Association.

Welcome, Mr. Merrill. We look forward to your testimony.

STATEMENT OF PHILIP MERRILL, EXECUTIVE DIRECTOR, MAINE STATE EMPLOYEES ASSOCIATION

Mr. MERRILL. Thank you, Senator. It is indeed a privilege to be here and somewhat humbling to be among so many experts. I do want to say that I am testifying today not only on behalf of the

Association for which I am Executive Director, the Maine State Employees Association, but a coalition of three organizations: My own, the State Employees Association of New Hampshire, and the Service Employees International Union, AFL-CIO, a coalition which has joined together to confront and try to deal with the problem that is sometimes referred to as the "sick building syndrome".

I want not to follow my written testimony today, but to comment directly on some of the questions that have been asked. That way, hopefully, I will provide some guidance from a personal view as a practitioner in the sense that I work daily with people who are exposed to these risks and to try to fashion solutions to their problems. In the dirth of standards that have been provided by the Federal or State government or any other agencies at this point.

First I want to address a question which seems to be at the heart of the political issue. It has been asked here in many different ways, but I think most citizens would ask it as Senator Chafee did when he asked "How have be Americans survived so long, are we now facing new threats or are we just learning more that is frightening." I would like to suggest that from the standpoint of what we are talking about, which is a particular part of the indoor air pollution problem, the sick building syndrome, that there are major changes taking place. What we are reacting to is substantive changes well as a change in information.

Up to about 15 or 20 years ago, we didn't have to give much thought as to how the air we breath got into buildings. We took for granted that whatever was outside got inside. We took that for granted, because frankly, buildings had windows that opened and buildings leaked. They weren't efficient at keeping air out.

Our response to the energy crisis has changed all that, maybe more acutely in our region of the country, Senator, than in other regions, but it has changed across the country. Now when we put people in offices to work, "in buildings constructed" since the energy crisis, the air that gets into them is not a matter of accident. It is not a matter of a building leaking or a window being opened; it is a matter of design.

If those buildings haven't been designed properly, and traditionally, they have not, the air doesn't get into the buildings and whatever is in the building that can cause problems is trapped air, and it becomes more concentrated.

Also, the systems themselves increase and make, if they are not maintained properly, a whole new risk. I represent in my membership, a gentleman who has had most of his lung removed, because fungus that grew inside a ventilation system got into his lungs and caused a condition where most of his lungs had to be removed. Maybe that is an extreme example of the kind of thing that can happen to somebody, as a result of this new way of bringing air into these buildings, but it demonstrates dramatically that we are largely dependent on a mechanical system for bringing in air.

If the system isn't designed properly, and many of them are not or if it isn't operated properly people will be sick. There is a great temptation, not to operate them properly, because when the air is 20 degrees below zero, as we experience in our part of the country outside, that is going to be the air brought in to replace the air

inside, you can save a lot of money, by closing the system, and not exchanging the air at the rate you should.

That happens, and people in the buildings get sick as a result of it.

I think that it is crucial that the Federal Government at least help establish a benchmark that we can all point to in terms of how much air should be brought in for people.

If the Clean Air Act means anything, if its statement of finding and purpose means anything, it is that people have a right to breath healthy air. That means they have a right to have air in the building, fresh air brought into it. Yet, there is no standard property determined by the Environmental Protection Agency, the Department of Labor or OSHA or anywhere else as to how much air we have to bring in per person per cubic foot per minute.

Somewhere, such a standard has to be established. I think that asking the Environmental Protection Agency to do that work, even if it only applied to Federal buildings, would be a great help to us.

There is a vast amount of research that has to be done with this problem. It has been alluded to. I would hope that you could get the Environmental Protection Agency to take the lead on this.

I wanted to also say in answer to just a couple of other questions that have been asked here, I think the Clean Air Act must include indoor air. As was already pointed out, that is where people spend most of their time. It is where whatever is in the air becomes most concentrated. Please take whatever actions this committee has to take to make clear that the objectives of the Clean Air Act and the directives of the Clean Air Act are extend to the air which people breathe wherever they breathe it in this country.

Finally, I will just say that I think that we are just at the beginning of the sick building syndrome problem, because with all these changes that have taken place in the way we design our buildings, we have spent, up until this time, very little time looking at what that means in the dangers that it poses. That is not the case in some of the Scandinavian countries, but it is the case in America. We are just beginning to pay the price for that lack of attention, and we are going to have to start facing the consequences of it.

I just will finish finally with this: We don't even know the consequences of it financially, let alone in health terms. One of the things that we hope to do with our coalition in Maine, and we will certainly share it with this committee as we go on, is to take a few of these buildings that we know have bad experiences, where the air hasn't been exchanged well and go back five or six years and to pull out all the health-related data that is available to us.

The State, directly and indirectly, pays for the cost of these people, because they buy the health insurance plans. They pay for the workers compensation policy, and the lost time. We have to pull them up and document them. We don't know what we will find. I strongly believe from the anecdotal evidence seen sitting in my position, that we will find that it costs the State more not to address the problem than it costs them to address it. That is the kind of information we need so that we will know what you are asking if you decide ultimately to demand that this problem be addressed.

Are you asking that a huge expenditure be made? Or are you actually asking that we make an investment now to save this money in the long term? EPA should be in the forefront of funding that and expanding that sort of investigation. If EPA has made any progress, I think it has been made by the progress of this committee, and I ask that it be continued.

Thank you.

Senator MITCHELL. Thank you very much, Mr. Merrill.

We are pleased to be joined by Senator Durenberger. Senator, the next witness is from Minnesota. Perhaps you would like to introduce her.

OPENING STATEMENT OF HON. DAVE DURENBERGER, U.S. SENATOR FROM THE STATE OF MINNESOTA

Senator DURENBERGER. Mr. Chairman, I am amazed at the flurry of hearing notices coming from the Subcommittee, but I shouldn't be, because your talent in getting out ahead of problems and your ability to bring the right people in here as witnesses is, if it wasn't well known before you came to the majority, certainly, it will be.

It is also a tribute to you that you recognize the State of Minnesota, regardless of who represents it, whether it is Ms. Oatman or me. Minnesota has always been a national leader in environmental and other areas.

Before there was an EPA, we had a pollution control agency, and so the first State environmental agency in the United States of America. That came after the Department of Health, which was opened and had begun monumental efforts in the area of clean air and clean water.

Since then, we have become the first State in the United States to have a clean indoor air act which is now nameless and, thanks to peer pressure, has been adopted at last. In the area of formaldehyde, the Minnesota Department of Health has been extremely helpful to this committee as it has with asbestos and lead. In a variety of areas, we have used people from Minnesota and their talent and the Department of Health and its talent over the past few years.

I compliment you in bringing the Minnesota Department of Health in the form of Ms. Oatman here today to continue that.

Senator MITCHELL. Ms. Oatman, welcome, and we look forward to your testimony.

STATEMENT OF LAURA OATMAN, MINNESOTA DEPARTMENT OF HEALTH

Ms. OATMAN. Chairman Mitchell and members of the Subcommittee, my name is Laura Oatman, and I work for the Minnesota Department of Health in our Division of Environmental Health. The purpose of my testimony is to summarize Minnesota's response to indoor air contaminants and to discuss State level policy issues related to indoor air.

I have also submitted written comments which provide more extensive information. The role of government in protecting indoor air quality falls into three broad categories: research, public information/education, and regulation. While not a distinct category,

communications and technology transfer must also be integrated into any effective response to indoor air pollutants.

Even though Minnesota's early activities related to indoor air were generally reactive, the State's experiences can be used as examples of successful and unsuccessful government attempts.

There are several key questions that need to be addressed in determining a State's response to indoor air problems. These include: The amount of publicness associated with the affected building. For example, public buildings and private residences need to be approached differently; two, are the exposures to the pollutant voluntary or involuntary; and three, what are the health risks associated with the exposure to that particular indoor air contaminant?

Additionally, the responses of government are often hampered by the lack of adequate funds.

Regardless of the role assumed by governments in safeguarding indoor air quality, communication plays a vital part in implementing that role. A communication gap exists between different States and other levels of government. One way of overcoming this lack of communication is the establishment of a clearinghouse for indoor air.

A key element to that clearinghouse would be a computerized reference service to help callers locate a response to specific substance. Minnesota's response to indoor air problems in homes, public buildings and non-industrial workplaces has mainly been reactive, and the State has responded to the issue on a pollutant-by-pollutant basis. Radon, formaldehyde, asbestos, tobacco smoke, volatile organic compounds, polychlorinated biphenyls, combustion byproducts, moisture and energy conservation have been the focus of the State's activities.

Minnesota currently regulates carbon monoxide and nitrogen dioxide in enclosed sports arenas, smoking in public buildings and formaldehyde in building materials. Minnesota's experiences with public education efforts demonstrated that a State could not rely upon news media to convey accurate information to the public.

Fact sheets and brochures were more successful. Numerous nonprofit and professional organizations, including several of them sitting at this table, have provided resources that have expanded the State's educational campaigns.

Government agencies frequently use regulations in responding to emerging public health concerns. However, Minnesota's experiences show that regulations are not always the appropriate response to indoor air problems.

The most successful use of indoor air standards in Minnesota has occurred in public buildings. These types of regulations usually receive the support of the general public. A poll conducted in May 1980 found that 92 percent of all Minnesota adults favored the State's law which prohibits smoking in public buildings except in specially designated areas. Minnesota's regulatory experience with formaldehyde in homes was not as successful.

The formaldehyde indoor air standard was difficult to enforce, and the burden of compliance was placed on the home builder instead of the manufacturer of the formaldehyde containing products. Public concern over specific indoor air contaminants is usual-

ly the driving force behind a State agency's decision to investigate problems that are associated with a particular pollutant.

Our Department records all public inquiries on indoor air and averages over 60 telephone calls per week. The types of inquiries are evenly divided between homes and public buildings. However, complaints account for only about 20 to 25 percent of the indoor air inquiries.

Many States do not have adequate funds or staff to conduct detailed research on emerging health issues. Decision-makers in State governments frequently adopt the position that State-generated tax dollars should not be used for research on problems of national scope or impact, but rather should be used to investigate problems unique to that particular State.

If the problem is nationwide, the Federal Government should take the lead role in research. As a matter of necessity, States will continue to be active in indoor air quality research. Citizens with complaints usually contact State and local health departments for information on indoor air, and these agencies often lack the necessary resources to be able to provide accurate responses to these inquiries.

This paucity of data forces State agencies to conduct limited investigations on indoor air quality issues. While States and probably local governments will retain a role in research activities, the Federal Government should take the leadership role in conducting some broad-based studies and in coordinating research done by individual States and academic institutions.

Providing information which is accurate and easy to understand is government's most important role in responding to indoor air problems. But agencies need to decide where limited funds for education can be used most effectively. As discussed earlier, our department records the number and types of inquiries received on indoor air.

The recording of these calls not only allows the Department to rank indoor air subjects by frequency of request for information, it also helps us to recognize new areas of public concern.

Regulation through the setting of standards for indoor air must take into account the type and location of the exposure. For example, the air quality standards of OSHA are used for industrial settings and have been adopted to protect healthy workers exposed over an eight-hour per day interval.

Evenly though the workplace includes both industrial and office settings, the health status of some individuals in non-industrial settings may make them more susceptible to the adverse health effects to exposure from air contaminants. Therefore, a different set of standards or guidelines needs to be used for air quality in the non-industrial workplace. The issue of indoor air quality is a complex one that is further complicated by the lack of clear-cut authority in most States and at the Federal Government level.

It would be very beneficial to the states if Congress could designate a lead Federal agency. The best choice appears to be the Environmental Protection Agency. However, there are some possible problems with this choice. The EPA usually interacts with state environmental protection agencies while indoor air programs are gen-

erally located in the state health agencies. This may require the EPA to establish new contacts within several States.

In addition, EPA should continue to rely on the expertise and regulatory authority that currently exists in the other Federal agencies regarding indoor air. Achieving healthful air quality in the indoor environment is a complicated challenge, but it is not an impossible task.

All levels of government, along with industry, non-profit organizations, and consumers, need to work together to achieve this goal. I would like to express my appreciation for having had the opportunity to share our Department's thoughts and concerns with you, and I will be happy to respond to any questions you may have.

Senator MITCHELL. Thank you, Ms. Oatman.

Our final witness is Mr. Stephen Brobeck, Executive Director for the Consumer Federation of America.

Mr. Brobeck, welcome. We look forward to hearing from you.

STATEMENT OF STEPHEN BROBECK, EXECUTIVE DIRECTOR, CONSUMER FEDERATION OF AMERICA

Mr. BROBECK. Thank you very much, Mr. Chairman. We greatly appreciate the opportunity to testify this morning and commend you for your continued leadership on this important issue.

It is the end of a long morning, so I would like to try to put into practice Leo Durocher's other maxim that nice guys finish fast.

Senator MITCHELL. You have already endeared yourself to the Committee's heart.

The fact that nice guys finish fast.

Mr. BROBECK. Let me make three points drawn from my written testimony. The first is that the Consumer Federation sees indoor air pollution as the nation's number one hidden health threat. Individual pollutants ranging from radon to asbestos to secondary tobacco smoke, to formaldehyde and methylene chloride may well kill tens of thousands of Americans every year and injure millions more.

As you yourself mentioned in your introductory remarks, when Oak Ridge Laboratories examined 40 homes, they found between 20 and 150 hazardous chemicals in concentrations between 10 and 45 times greater than is found in the outdoors.

That is why the EPA, in its recent reassessment of 31 environmental hazards, ranked radon first and indoor air pollution from other sources fourth as a threat to public health.

Despite these findings, most of the public is still not fully aware of the hazards to their health. Recently, a national pollster asked a random sample to rate the health risk of indoor air pollution, and they rated it low; below that, even, of other problems like oil spills.

My second point is that in part because of this lack of public awareness, the Federal Government is not giving indoor air quality adequate attention. What attention it has given is largely the result of your leadership, Mr. Chairman, and other members of the Subcommittee. The inclusion of the radon gas and Indoor Air Quality Research Act and Superfund legislation, for example, represented a great advance, and this must be fully funded.

But the rest of the Federal Government needs to take indoor air pollution far more seriously than it has. There is ample evidence of this lack of attention. Let me give you three examples very briefly.

EPA ranks indoor air pollution as a high risk, but as their recent report acknowledges, they give it low priority. Second, even though all the dollars spent on outdoor air research are well spent and probably ought to be increased, these exceed the research funds for indoor air quality research by a factor of greater than 10 to 1.

Third, the CPSC, which, is responsible for the safety of substances, including methylene chloride, formaldehyde and asbestos, in consumer products, spends the ridiculously low sum of $250,000 on indoor air pollution, plus the time of two staff persons.

My third and final point is that there is much that this Subcommittee and Congress can do to constructively respond to indoor air quality health hazards. We have included over a dozen specific recommendations in our written testimony. Let me mention just a few of the most important.

Radon, as the most important human health threat, clearly needs the most attention. CFA strongly supports S. 744, and we urge its speedy approval. This would greatly enhance EPA's ability and responsibility to provide technical assistance to the states. But in doing so, Congress mustn't neglect other pollutants. It must keep in mind that these were ranked fourth on EPA's list of 31 hazards.

Concerning asbestos, CPSC or EPA both have statutory authority, as should be required, to ban asbestos in consumer products. Concerning secondary tobacco smoke, Congress should pass legislation limiting smoking in public places and, consistent with the recommendation of the National Academy of Sciences, banning it in airplanes.

As to formaldehyde, CPSC should be directed to strengthen voluntary standards for formaldehyde and pressed wood products, and if they are unwilling to do so, they should be urged to ban its use entirely.

Concerning methylene chloride, CPSC should be monitored as it considers its ban on methylene chloride in consumer products. And concerning chlordane, EPA should be required to ban this chemical for termite control.

Now, even if all these actions are taken, health officials, builders, consumers, and others still need information on hazards, control and mitigation strategies and resources.

That is why a number of groups, including representatives from several Federal agencies, are seeking to establish an independent clearinghouse of information. Though we have already received some financial commitments, CFA is not certain whether this concept can become a reality without some very modest Federal funding. CFA suggests an equal Federal and non-Federal contribution with the goal of a $1 million budget annually. I would hasten to add that this clearinghouse would be independent of any radon clearinghouse required by the passage of S. 744.

Again, I would like to thank you for the opportunity to testify and commend you for your leadership.

Senator MITCHELL. Mr. Brobeck, thank you very much. Thank you all for your testimony.

I have no questions. Senator Pressler has some he wants to ask. I will have to leave to go to the floor to introduce some legislation before the Senate recesses. Your testimony makes clear that this is a serious problem; that we should be acting with respect to its policy in relation to the Clean Air Act and that we ought to have EPA as a principal agency responsible for it.

That is useful information for us as is your and other testimony that we have had. We intend to press forward confidently and vigorously in this area. Thank you all very much. It has been very helpful.

Senator Pressler, thank you for concluding the hearing.

Senator PRESSLER [presiding]. Thank you.

Let me ask you some questions that are of interest to me and, I think, others.

What about paints and paint thinners that are used in indoor structures? Are they at all a pollutant?

Mr. BROBECK. They represent a very serious health threat because they contain methylene chloride, which is a known carcinogen, and, in fact, is recognized by the staff of the CPSC to be the most hazardous product in terms of indoor air pollution that they are currently looking at.

Senator PRESSLER. What can we do about paints?

Mr. BROBECK. We think that probably we are just going to have to ban the use of methylene chloride in paint thinners and strippers. That may increase the expense a little. There are alternative substances that can be used in those products. But it represents such a serious health threat because most consumers are not aware of the dangers posed by these products. So they often use them in rooms that are not adequately ventilated. That subjects them to great risk.

Senator PRESSLER. What about poisons for mice and rats? I have read in the Washington Post that in the poorer sections of Washington, DC, that this is a constant problem. Even in the wealthy section of Washington, DC, most of the people who own a house have an exterminator come once or twice a year and put poison in crawl spaces or basements and so forth. I suppose in any big city there is that problem, Washington, DC, seems to have more of a problem than most.

What about the poisons? Do they give off or emit things even in a crawl space, below the house?

Mr. BROBECK. The poison used by pest controllers that concerns us the most is chlordane. It is used for termite control.

Senator PRESSLER. Pardon?

Mr. BROBECK. Chlordane in termite control.

Senator PRESSLER. Termite control, but for mice and rats, their poison doesn't concern you?

Mr. BROBECK. It certainly does. We have a problem here. Obviously, you want to eradicate pests.

The substances that are used for pest control are, by their nature, very, toxic. So we have to balance the health versus economic and other factors and also make certain that we are educating consumers and others who use these pesticides in a proper way.

Senator PRESSLER. What about mice and rat poisoning? What does it contain as the problem?

Mr. BROBECK. I can't answer that question.

Senator PRESSLER. But for bugs and roaches and so forth, there is a specific problem?

Mr. BROBECK. Chlordane is used for termites, in particular. It is highly toxic and a carcinogen and, we believe, should be banned.

Senator PRESSLER. Is that sold regularly in spray cans?

Mr. BROBECK. It is used by termite controllers.

Senator PRESSLER. What about copying machines? We have had some discussion about that earlier. With copying machines, if you take the first copies of a copying machine and they are at least telecopies, do they have a problem?

Dr. GODAR. These are standard office copies. Someone with asthma would experience immediate reaction on simply handling a collection of papers that has been reproduced recently.

Senator PRESSLER. What material is contained in it?

Dr. GODAR. Formaldehyde is one of the breakdown products, and there are others. I can't list all of them. They are volatile, and they outgas over an extended period of time, so that aeration alone is not adequate to reduce chemical exposure unless there is considerable air exchange in the area.

Senator PRESSLER. What about telecopying machines? What do they have that causes problems?

Dr. GODAR. I can't answer what the chemical is, but I do know that some patients are sensitive to it.

Senator PRESSLER. It is not carcinogenic?

Dr. GODAR. Not to my knowledge, but it wouldn't surprise me. That is a question that can't be answered currently.

Senator PRESSLER. With all of our modern technologies and conveniences, it is sort of a down side, apparently.

Are there any other things that pollute inside of rooms? This is mainly on air quality, but can any member of the panel suggest any further ones that we have overlooked or haven't dealt with?

Mr. MERRILL. I might just add that we have experienced one kind of pollution inside of buildings that hasn't been mentioned as a source here, and for purposes of making a complete list, I might just mention it, and that is, we had a building in which groundwater contamination has caused a major health problem in the building in that when the water level rises, it brings this contaminated water into the basement of the building and then its evaporation is disbursed throughout the building. It can cause serious health problems.

Senator PRESSLER. What kind of pollution is that?

Mr. MERRILL. Actually, there are three sources of pollution that came together under the building that had previously been in kind of a storage dump there. The building was constructed where chemicals had been disposed of inside of a barrel. There was a dry cleaning place that operated for 50 years. For their earlier years, it dumped whatever they used for dry cleaning in the ground, and there was an old filling station that left their oil tank to just deteriorate and put petroleum products in the ground.

These three fumes came together on the building and then brought this together into the basement. It got caught up in the circulatory system.

I think that if that makes any point, I just would emphasize that I think a lot of these problems come out on an accumulated sense, and to some extent, all of them, or almost all of them, can be mitigated by seeing to it that a lot of fresh air is brought into the building.

Given that as the precedence, in the case of the copying machines and others, except for people extremely sensitive, it would go a long way to its mitigating problem. Absent that, the problem becomes cumulative. It is such a simple solution probably it exceeds the ability of the Congress to accept it. But fresh air would go a long way toward solving a lot of these problems.

It seems to me a minimal demand that we should demand on the Clean Air Act that people have a right to breathe when they are inside.

Senator PRESSLER. Thank you very much.

Unless the committee has further business, I will thank our witnesses for their time and trouble and I will close this hearing.

[Whereupon, at 12 p.m., the subcommittee was recessed, subject to the call of the chair.]

[Statements submitted for the record follow:]

STATEMENT
OF
A. JAMES BARNES
DEPUTY ADMINISTRATOR
U.S. ENVIRONMENTAL PROTECTION AGENCY
BEFORE THE
SUBCOMMITTEE ON ENVIRONMENTAL PROTECTION
OF THE
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
UNITED STATES SENATE

APRIL 24, 1987

Good morning. I am pleased to be here today to discuss with you the health effects of exposure to indoor air pollution and EPA's efforts to implement the Radon Gas and Indoor Air Quality Research Program required under Title IV of the Superfund Amendments and Reauthorization Act of 1986 (SARA).

Indoor air pollution is not a new issue. Historically, concern over indoor air pollutants and development of Congressional and programmatic initiatives have closely paralleled discovery of significant indoor air quality problems. In the 1970s, formaldehyde was identified as the cause of irritant reactions in people exposed to it and formaldehyde risks began to be addressed by EPA, the Consumer Product Safety Commission (CPSC), and others. As far back as the mid-1960s, the cancer risks of asbestos became known to the Federal health agencies and programs emerged to address asbestos containment and removal, especially in schools. Concern over the health effects of radon gas also began in the 1960s and 70s and the discovery of high levels in residences led to the development of EPA's Radon Action Program in 1985.

Until recently, however, the nation's approach to air pollution has been primarily directed at the outdoor or ambient air pollutants. Our focus on the specific problems associated with pollutants indoors has increased as their serious health effects have become known and publicly recognized.

This approach has allowed the nation to bring resources to bear on the most significant health risks as they were identified and to take effective steps toward mitigating the risks which pollutants such as radon pose to public health. As a result of our efforts to address these specific indoor air pollution problems, we have come to understand that pollutants in the indoor environment may pose a more serious risk to health than previously thought.

Recent research suggests that various environmental air pollutants exist indoors emanating from a variety of sources, including infiltration of outdoor pollutants such as radon and carbon monoxide. Additionally, indoor sources such as combustion appliances, tobacco smoke, home furnishings, building materials, and thousands of commercial products may add to indoor air pollution.

Most people spend up to 90% of their time in residences and other buildings that have become increasingly more airtight with the trend in the last 10-15 years toward greater energy conservation. Recent studies demonstrate that for some pollutants indoor exposures are two to five times greater than outdoor exposures to the same pollutant.

EPA enters the field of indoor air pollution from the perspective that total exposure to pollutants should be reduced if needed to protect public health. Since an individual's largest exposure time exists indoors, EPA's focus on indoor air pollution sources has been a logical and important extension of efforts underway to protect the population from exposure to ambient pollutants.

In response to the mounting concern over indoor air pollution, Congress has appropriated approximately $2 million dollars in each of the last three fiscal years for EPA research into indoor air pollution. In Title IV of the 1986 Superfund amendments, Congress for the first time gave EPA a clear mandate to establish a Federally coordinated indoor air and radon research program, to disseminate information on indoor air pollution sources, exposures, health effects, and mitigation techniques, and to assess the appropriate Federal role in solving indoor air pollution problems.

Before discussing our progress in implementing Title IV, I would like to briefly review the efforts we have made in dealing with indoor air pollution.

From a regulatory standpoint, the Agency has already addressed, and is continuing to address, a number of chemicals and pesticides found indoors through the use of the Toxic Substances Control Act (TSCA) and the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). These statutes enable

EPA to obtain information from manufacturers and processors on chemical substances when we have reason to believe that their use may present an unreasonable risk to human health and the environment. If, based on an assessment of the risks and benefits of a substance, we determine that an unreasonable risk exists, we can take action to control exposure to the substance, restrict its use, or ban the substance entirely.

To date, the Agency has taken a number of actions on specific chemicals that have been found to pose risks indoors. EPA has issued the Asbestos Worker Protection Rule to protect public employees not covered by OSHA from exposure to asbestos during abatement activities. We have also proposed to phase out commercial uses of asbestos over a ten year period. This proposed rule -- known as the Asbestos Ban and Phase Down Rule -- may significantly reduce future uses of asbestos and exposure to asbestos fibers in all environments, including indoors. We have just issued a proposed rule, the Asbestos in Schools Rule, under the Asbestos Hazard Emergency Response Act (AHERA) passed by Congress in October 1986. This rule will require schools to inspect for asbestos, prepare management plans, and take appropriate response action when friable asbestos is found.

In 1986, EPA prohibited the use of pentachlorophenol as a wood preservative for treatment of logs for log-home construction and generally prohibited use of pentachlorophenol and creosote for indoor use, with some very limited exceptions.

In 1985, the Agency cancelled most uses of the pesticide lindane, including its use in indoor fumigating devices to control pests.

EPA is currently evaluating monitoring data we recently received from manufacturers on chlordane as well as examining the health effects and benefits data for chlordane and other termiticides (heptachlor and aldrin/dieldrin) to determine if further regulatory action is necessary. We expect to make a decision this summer.

On April 16th, the Agency announced the results of its risk assessment on formaldehyde, a probable human carcinogen. We are now moving toward a decision on what regulatory action may be necessary. We will be looking primarily at formaldehyde emissions from plywood and particle board used in mobile and conventional homes. We have also shared our findings with OSHA and HUD for consideration in any actions they may take.

In addition, under the Safe Drinking Water Act (SDWA), we have proposed to reduce exposure to volatile organic chemicals that can escape from tap water by establishing maximum contaminant levels.

We have also pursued a successful non-regulatory program to mitigate risks from radon exposure in residences through demonstrations, technical assistance, training, and information dissemination.

In the research area, we have also made progress in addressing indoor air pollution. One of the most important research contributions which EPA has made is the development and testing of the Total Exposure Assessment Methodology -- or TEAM studies. The TEAM approach uses state of-the-art instrumentation and a unique blend of scientific approaches to determine human exposure to pollutants. The initial TEAM studies, which focused on volatile organic compounds, provided us with critical evidence of the extremely high concentrations of some volatile compounds indoors. We are currently expanding the TEAM studies to investigate total human exposure to particulate emissions and pesticides.

Similarly, through the innovative Integrated Air Cancer Program, EPA has been able to develop and field test instrumentation and methods to characterize carcinogens in ambient and indoor air, and to pioneer new ways to evaluate complex mixtures of pollutants to discover the most potent pollutants and to screen for possible health effects.

In addition, we have made several significant advances through specific health effects and source characterization studies. For instance, we have completed the exposure portion of a clinical study of children whose parents smoke cigarettes and have initiated a pilot field study to examine the levels of nicotine in children of smoking parents as well as to evaluate indoor levels of nicotine and other pollutants in the homes where the children live. This work will help us to better

understand the effects of environmental tobacco smoke and develop and disseminate information on the health risks which exist for children of parents who smoke.

Through an innovative test chamber program, we have pioneeced and conducted extensive research to determine the composition and rate of pollutant emissions for several common building materials and consumer products, including flooring materials, construction adhesives, paints, floor wax, and moth crystals.

Significant progress has also been made in the standardization of emission testing procedures and in the development of much needed personal and fixed monitoring equipment for assessing human exposures to indoor air pollutants. We are also conducting studies to develop a model which can be used to estimate exposure from volatilization of chemicals from tap water into the home.

This work is complemented by important research being conducted by other Federal agencies. For example, the Consumer Product Safety Commission (CPSC) has advanced our knowledge about emissions from sources commonly found in homes, including combustion appliances and products containing formaldehyde and methylene chloride. CPSC has also initiated studies on humidifiers, which can spawn biological contaminants.

In addition, the Department of Energy has conducted studies on the relationship between indoor air quality and energy conservation, including measurement and modeling for both large and

small buildings. DOE is also conducting basic radon studies, including health effects, epidemiological, and building science studies. We are close to finalizing a Memorandum of Understanding with DOE to coordinate our programs. DOE will have primary responsibility for basic research, with their primary focus on health studies; EPA will be responsible for applied research, technical studies, and operational programs dealing with the States and the private sector.

The Department of Health and Human Services coordinates and provides the major Federal funding for a large joint Federal study of health effects from exposure to indoor and outdoor pollutants which is known as the Harvard "Six Cities" study. In addition, the National Institute for Occupational Safety and Health (NIOSH) has conducted over 400 investigations of sick building complaints.

Historically, EPA has recognized the need for interagency approaches to pollution research, as illustrated by our continuing cooperation in the Harvard "Six Cities" studies and associated efforts. Likewise, EPA was a major player in the highly praised exposure assessment studies in Kingston-Harriman, Tennessee. This philosophy continues in EPA, perhaps best illustrated by our current plans to participate in the Third National Health and Nutrition Examination Survey (NHANES-III), sponsored by the National Center for Health Statistics. In addition, EPA participated in the National Academy of Science (NAS) study which led to the Surgeon General's recent announcement on environmental tobacco smoke and health.

In fact, one of the major elements of the Agency's indoor air program will involve efforts to improve the coordination of Federal, State, and private sector indoor air research and mitigation efforts. In many respects, mitigation of the most serious indoor air pollution problems is feasible only because of the large number of Federal, State, and local agencies and private sector organizations with indoor air related responsibilities and resources to bring to bear on the problem. At the same time, keeping track of the various activities and contributions of these myriad organizations with indoor air concerns is a mammoth task. Both EPA and Congress have recognized the tremendous need for coordination among all these parties. Toward this end, a number of advisory and coordinating bodies have been established.

Within EPA, an indoor air working group has been established with representation from all EPA offices concerned with indoor air pollution issues. An Air Research Committee co-chaired by policy and research staff decides how to integrate competing research priorities and allocate the available resources. Finally, the Science Advisory Board (SAB) reviews ORD research plans and products.

To coordinate the activities of the 16 Federal agencies with indoor air responsibilities, the Interagency Committee on Indoor Air Quality (CIAQ) meets formally on a quarterly basis, with workgroups and staff meeting as needed throughout the year. We intend to explore ways to strengthen the working

relationship between EPA and the most active Federal agencies. For example, the Department of Energy has done research on the role which ventilation plays in both energy conservation and indoor air quality. Since we also recognize the potential significance of ventilation systems to indoor air quality, we will explore with DOE whether additional coordinating mechanisms might benefit our mutual interests in the indoor air field.

Much more work needs to be done to adequately assess the health risks of various indoor air pollutants and to identify and demonstrate appropriate mitigation strategies. The indoor air pollution problem must be attacked systematically, and EPA has, in the last several months, taken a number of actions to identify short and long term indoor air research needs and to establish a policy framework that will permit the Agency to focus its research and mitigation efforts on the most pressing indoor air pollution problems.

Prior to the enactment of SARA, the Agency had begun a comprehensive assessment of the current state of knowledge about indoor air pollution sources, human exposures, health effects, and mitigation techniques. This assessment allowed us to identify critical gaps in our knowledge and understanding of indoor air pollution and will continue to serve as an information baseline for prioritizing our research needs. A preliminary draft of this assessment was the subject of an extensive peer review by a group of experts on indoor air convened by Harvard University at the Agency's request in January of this year. That review proved extremely useful in sharpening the focus of our information assessment.

The next priority in planning future research was to begin to identify research needs which must be met in order to characterize the human health problems posed by indoor air pollution and to identify and implement appropriate mitigation strategies. A preliminary research needs statement has been drafted and is now undergoing review within the Agency. Both the information assessment and research needs documents will be submitted to the Agency's Science Advisory Board (SAB) and to the Congress in the near future as part of the Agency's implementation plan for Title IV.

In order to ensure that the Agency's indoor air activities are well coordinated and to establish a clear policy context for the Agency's indoor air program, a new policy staff on indoor air quality was formed within the Office of Program Development in the EPA's Office of Air and Radiation. This office will have the primary responsibility for establishing the Agency's comprehensive indoor air policy, for developing public information on indoor air pollution, and for ensuring that all of EPA's indoor air activities are well-coordinated.

In many respects, EPA's policy for addressing remaining indoor air pollution problems will closely parallel the Agency's approach to dealing with indoor radon. The first element is, of course, to characterize the magnitude of the indoor air problem and assess the risks which various pollutants and pollutant mixtures pose to human health. While we know a good

deal about the potential sources and specific pollutants that may be found indoors, we must develop better means to de determine: 1) what pollutants are present; 2) in what concentrations; 3) the total human exposure to these pollutants and pollutant mixtures; 4) the health and welfare effects of these exposures; and 5) what can be done to mitigate or prevent exposures to pollutants which pose risks to human health. In addition, in order to fully address indoor air pollution, it would be useful to develop models and monitoring and assessment methods to characterize overall indoor air quality.

The second element of the Agency's indoor air program will be to rank various indoor air pollution problems for further research or mitigation. In contrast to the Radon Action Program, which is able to focus its resources on a single pollutant with known health effects, we will need to focus other indoor air program resources on the most immediate needs of the most potentially serious problems.

The third element of the Agency's indoor air policy will be the identification and evaluation of appropriate mitigation and prevention strategies. While eliminating pollutants at their source is often the preferred method of mitigation, the complexity and large variety of indoor air pollution sources dictates that the Agency also pursue broader strategies. Because we know that building construction and ventilation methods contribute significantly to the quality of the indoor

environment, considerable emphasis will be placed on mitigation strategies that address multiple pollutants and pollutant sources simultaneously. We need to evaluate quantitatively the impact of building design, building materials, and ventilation systems on indoor air quality and to validate air exchange models. We also need to develop protocols for diagnosing and assessing building related illnesses, including the "Sick Building Syndrome". Finally, we need to develop methods for measuring ventilation effectiveness and to identify changes in building design or ventilation practices that will improve delivery of good indoor air to the building occupant.

The fourth element of the Agency's indoor air program will be to implement appropriate mitigation strategies to reduce the risks to human health. EPA's primary emphasis in implementing mitigation strategies will be to develop and effectively disseminate information that will build the capacity of State and local governments as well as individuals and organizations in the private sector to identify, assess and solve indoor air quality problems at the State and local level. At the same time, the Agency will exercise its existing authorities under FIFRA, TSCA, or the Safe Drinking Water Act (SDWA) if we determine that such action is appropriate. In addition, to the extent that the Agency identifies problems that are more appropriately addressed by other Federal agencies, we will refer those problems to the appropriate agency. Finally, we will assess the regulation of indoor air pollutants under our existing statutory authorities and make appropriate recommendations to the Congress.

In the immediate future, the Agency will move forward on several fronts. As I mentioned earlier, a detailed implementation plan is undergoing review within EPA as well as the members of the CIAQ and we hope to be able to transmit this report to Congress in the near future. This report will set forth the Agency's research needs over the next 18 to 24 months, as well as related program activities, including Federal, State, and local coordination and an assessment of the appropriate Federal role in mitigation.

Research will continue in a number of priority areas. Foremost among these near term needs is the development of better data characterizing human exposure and health effects of various pollutants. This will involve continued work to develop and validate appropriate models, assess the reliability and utility of existing exposure data, and perform limited field monitoring, as resources permit, to test and supplement the data gathered from use of indoor air models. We may also use our statutory data-gathering authority -- such as TSCA and FIFRA -- to obtain additional data. We intend to convene a workshop of technical experts in the field this summer to assist us in scoping out this effort.

Also in the research area, we are considering expanding the work being done on volatile organics from all sources, including drinking water, to better understand the risks they pose indoors. In addition, we will continue work to develop personal and unobtrusive stationary monitoring equipment for many indoor air pollutants. Effective monitors already exist for radon, carbon monoxide and nitrogen dioxide.

In addition to basic and applied research, our major emphasis at this time is to begin to disseminate known information on indoor air pollution problems and solutions. Significant information in the field of environmental tobacco smoke already exists and we are in the planning stages of a handbook on the diagnosis, mitigation, and prevention of exposures to ETS. We plan to prepare this handbook in cooperation with the Public Health Service (including the Surgeon General's Office), the National Institutes of Health, and the Centers for Disease Control.

Another area in which we intend to begin to disseminate information while at the same time continuing much-needed research is in the area of diagnosis, prevention, and mitigation of building-related illnesses. A particularly visible case of such a problem occurred in Washington only a few weeks ago at the headquarters of C&P. In many "sick building" cases, relating peoples' symptoms to specific pollutants--or even determining if those symptoms are building-related at all -- is a difficult and complex task. There is a critical need to begin to improve the private sector capacity to deal with such problems. We have recently begun a joint project with the California Council of the American Institute of Architects, the American Society of Heating, Refrigeration, and Air-conditioning Engineers (ASHRAE) and the American Occupational Medical Association to begin to compile known technical information into a format useful to architects, builders, building owners and occupants of non-

residential buildings. We have also been coordinating this work with DOE and the National Institute of Occupational Safety and Health (NIOSH).

Finally, we are going to develop basic information on indoor air pollution and inexpensive prevention and mitigation options, targeted to the general public in a booklet format.

Indoor air pollution presents complex problems and formidable challenges. Nevertheless, I am confident that as our understanding of the risks associated with indoor air pollution -- and the control strategies available to deal with those risks -- grows, we will see substantial progress toward ensuring a healthful indoor environment.

At this time, I would like to conclude my formal remarks and would be happy to answer your questions.

STATEMENT

JAN A.J. STOLWIJK

CHAIRMAN, DEPARTMENT OF EPIDEMIOLOGY AND PUBLIC HEALTH
YALE UNIVERSITY SCHOOL OF MEDICINE

before

Subcommittee on Environmental Protection
Senate Committee on Environment and Public Works

April 24, 1987

It is a privilege to be able to discuss what we know of the consequences of exposure to indoor air pollutants and of options to reduce such exposures before this subcommittee which contains in its members such high achievements in the protection of the environment and the health of the public.

The quality of the air in any given indoor space is a complex function of the sources of air pollutants in that particular space, and the rate at which outdoor air enters into the space through infiltration and ventilation, serving to dilute any pollutants being released in the space. In addition, the quality of the outdoor air has an obvious role because the more ventilation is used to improve indoor air quality, the closer indoor air will approach outdoor ambient air quality. There are yet additional factors such as the type of surfaces in indoor spaces which have a usually more secondary role.

The net result is that almost every indoor space is different from any other space in the quality of the air it contains. In fact, a given space may have very different levels of air quality at various hours of the day or the week, because the different factors mentioned before vary over time.

Because of these reasons it is difficult to make very precise general estimates of the seriousness and extent of the health threats posed by exposure to indoor air pollutants. A number of investigations have yielded large numbers of measurements of the concentration of one or more pollutants in various types of indoor spaces, and these measurements, if a concerted effort were made to consolidate them, would help a great deal to describe the national distribution of exposures. In some instances such measurements can be evaluated, and for some pollutants and health consequences we are in fact able to make reasonable preliminary estimates.

One example is the currently much increased concern with the distribution of radon exposures indoors, and with the possible health consequences. It is clear that the outcome of radon exposures is an increased risk of lung cancer in the exposed population. There are several organizations which have collected large numbers of measurements of radon levels in residential environments, independently of each other. In the United States, there are two such sources which I would like to refer to. One is a published compilation of measurements by the Terradex Corporation, and the other source are the measurements carried out by Dr. Bernard Cohen of the University of Pittsburgh. Each contains many thousands of measurements in many States. There are well-considered and reviewed estimates of the excess lung cancer risk resulting from radon daughter exposures, with a recent one published by the European Regional Office of the World Health Organization in Copenhagen (1987).

When such radon distribution data, and the associated risk data are combined and applied to the U.S. population it is possible to construct tables which show very clearly the extent and the seriousness of the risk due to radon exposures. Experts may have disagreements with one or more facets of such a table, and the resolution of any such differences could be incorporated to lead to very broad acceptance. It is suggested that tables of this type can provide increased clarity in this complex issue, and may

help in the development and evaluation of strategies and policies.

A number of such tables are presented in this testimony to illustrate that a body of knowledge does exist which can be applied directly to the problem of indoor air pollution if it is presented in this particular form. These tables, if they are seen as useful, also indicate clearly what the current state of knowledge is with regard to a particular pollutant and its estimated health impact, and may help to identify important gaps in our knowledge, and to suggest research priorities. If these tables are reasonable indicators for avenues of exposure reduction, it would be efficient to target research so as to allow the construction of well documented tables of this type for every pollutant and every health outcome of concern.

Table 1

DISTRIBUTION OF RADON EXPOSURES AND LUNG CANCER RISK IN U.S. POPULATION
Based on a population of 230,000,000, and radon distribution in U.S.
Risk: 2.0 annual excess lung cancers per million people / Bq/m3 EER

Fraction of pop. %	Indoor pCi/l	Radon Bq/m3 EER	Annual risk/mill. indoor exposure + 2 Bq/m3 outdoors	Annual Excess Deaths	Annual Due to indoor exp.
5.00	0.1	0.93	2	26	17
10.00	0.3	5.55	10	223	204
10.00	0.5	9.25	16	359	340
20.00	0.8	13.88	23	1,058	1,021
20.00	1.4	25.90	42	1,943	1,906
20.00	3.2	59.20	96	4,394	4,357
10.00	6.2	114.70	184	4,239	4,221
3.00	15.0	277.50	445	3,069	3,064
1.25	32.0	592.00	948	2,726	2,723
0.50	48.0	888.00	1,422	1,635	1,634
0.25	100.0	1850.00	2,961	1,702	1,702
100.00		Totals		21,374	21,190

Table 1 is based on random radon measurements by Dr. B. Cohen, U. Pittsburgh and this sample is likely to reflect actual radon distribution as found over much of the U.S. Better measures could be produced. Table 2 is based on a large number of measurements obtained by a different method by the Terradex Corporation. These measurements are likely to be biased to high values because they were done at the request of home owners who were likely to be concerned, and had some reason to be. Dr. Cohen has a similar set of measurements and in his laboratory they were found to be almost twice as high on average as the set shown in Table 1.

The radon concentration distribution in Table 2 is based on radon measurements by the Terradex Corp. of Walnut Creek CA. It is important to note that the distribution of concentrations in Table 1 and 2 is not dramatically different although the concentrations in Table 1 are

consistently lower, and lead to an estimate of the total annual incidence of excess lung cancer in the U.S. population which is about half that derived from the Terradex numbers.

Table 2.

DISTRIBUTION OF RADON EXPOSURES AND LUNG CANCER RISK IN U.S. POPULATION
Based on a population of 230,000,000, and radon distribution in U.S.
Risk: 2.0 excess lung cancers per million people per year / Bq/m3 EER

Fraction of pop. %	Indoor Radon pCi/l	Bq/m3 EER	Annual risk/mill. indoor exposure + 2 Bq/m3 outdoors	Annual Excess Deaths	Annual Due to indoor exp.
4.39	0.2	2.96	6	56	48
9.02	0.4	6.85	12	244	227
18.11	0.8	13.88	23	958	925
24.41	1.5	27.75	45	2,538	2,493
20.52	3.0	55.50	90	4,229	4,191
12.79	6.0	111.00	178	5,248	5,224
6.22	12.0	222.00	356	5,093	5,081
2.26	48.0	888.00	1,422	7,389	7,385
1.13	96.0	1776.00	2,842	7,387	7,385
0.47	192.0	3552.00	5,684	6,144	6,144
0.18	249.0	4606.50	7,371	3,052	3,051
99.50		Totals		42,338	42,155

The form of presentation of these estimates allows easy inspection of the number of people affected at each concentration level, and it also allows easy inspection of the protective effects which can be obtained by reducing these exposures. This pollutant clearly leads to serious consequences, and Table 1 and 2 would suggest that reduction of the radon levels would help at practically all levels of exposure, although the risk reduction benefit per house would clearly indicate that the residences with the higher exposures should be dealt with in a more urgent way. The differences between Table 1 and Table 2 are not such that action should be delayed: either projection clearly warrants efforts to reduce these exposures.

Similar estimates can be made for a number of other pollutants. One such pollutant is benzene which was studied in the Total Exposure Assessment Methodology study carried out for the EPA. This very important and carefully planned and executed study yielded exposure data for outdoor and indoor environments for a number of pollutants in a number of locations. In Table 3 these exposures are presented with a risk factor accepted by the European Regional Office of the World Health Organization in their assessment of 28 air pollutants for air quality guidelines. Again experts might disagree with the exact values as presented, but a consensus could undoubtedly be developed which again would form a solid basis for the evaluation of this particular pollutant in the indoor environment. Although the exact numbers in Table 1

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and Table 3 might change as new data develop, such changes are not likely to cause a drastic difference. The numbers in Table 1 and Table 3 do indicate that the effects of current levels of benzene exposure as described in the TEAM study are lower by two orders of magnitude than the effects of current exposures to radon. Exposure reductions would still be of value, but their urgency would be considerably lower.

Table 3.

DISTRIBUTION OF BENZENE EXPOSURES AND LEUKEMIA RISK IN U.S. POPULATION
Based on a population of 230,000,000, and benzene distribution in U.S.
Annual risk of excess leukemia deaths per million: 0.05 per ug/m3

Fraction of pop. %	Benzene concentr. in ng/m3 indoors	outdoor	annual excess Leukemia risk this exposure	Tot ann. excess Leuk.	excess due to indoor exposure
5.00	1,000	100	10	0	0
10.00	2,000	500	20	2	2
10.00	5,000	1,000	49	5	5
20.00	10,000	7,000	110	22	19
20.00	20,000	10,000	211	42	38
20.00	40,000	15,000	411	82	75
10.00	50,000	20,000	516	52	47
3.00	75,000	30,000	774	23	21
1.25	200,000	40,000	1,971	25	23
0.50	300,000	60,000	2,956	15	14
0.25	400,000	100,000	3,988	10	9
100.00			Totals	278	253

There are a number of other potentially carcinogenic contaminants in the indoor air environment, but there is reason to believe (although no absolute certainty at this time) that their total carcinogenic impact would be considerably below that of radon at the levels indicated in Table 1.

Another very widespread indoor air contaminant is environmental tobacco smoke (ETS). It is present in the majority of U.S. residences in proportion to the total amount of tobacco smoked in each residence. A very large number of chemicals in gaseous and particulate form are present in ETS, and both the Surgeon General and the National Academy-National Research Council have recently issued reports indicating that excess illnesses of various types including lung cancer, acute respiratory illness and chronic respiratory illness are associated with exposure to ETS. Estimates of the quantitative impact or of the population exposure and its distribution are not easily made. An example of such an estimate can be seen in Table 4.

In contrast to the numbers in Tables 1, 2 and 3 the distributions and the associated health impact are given only for illustrative purposes, and the contaminant is indicated as Respirable Suspended Particles, a more

general contaminant than ETS. In order to actually present Table 4 with numbers in which one could have confidence one would need to have a better estimate of the distribution of exposures (the numbers in the first three columns) and one would need to have a sound estimate of the unit risk which expresses the number of expected excess cases of lower respiratory illnesses (LRI) associated with each microgram of pollutant per cubic meter of indoor air. The first requires measurement of pollutant concentrations in representative indoor environments, and the second requires epidemiologic studies in which the incidence of disease is determined together with the exposure in a large number of individuals.

Table 4.
(This table should not be quoted, its values are arbitrarily chosen for purposes of illustration only!)

POPULATION DISTRIBUTION OF RSP EXPOSURES AND EXCESS LRI RISK
Based on a population of 230,000,000, and RSP distribution in U.S.
Unit risk 2000.00 excess LRI per million per year per ug/m3

Fraction of pop. %	RSP concentr. ug/m3 indoors	outdoor	Excess LRI per yr per million	For U.S. population Tot. Excess LRI	Due to indoor exp
5.00	10.00	10.00	20,000	230,000	184,000
10.00	25.00	20.00	48,000	1,104,000	920,000
10.00	30.00	25.00	58,000	1,334,000	1,104,000
20.00	35.00	30.00	68,000	3,128,000	2,576,000
20.00	50.00	35.00	94,000	4,324,000	3,680,000
20.00	75.00	40.00	136,000	6,256,000	5,520,000
10.00	100.00	45.00	178,000	4,094,000	3,680,000
3.00	150.00	50.00	260,000	1,794,000	1,656,000
1.25	200.00	55.00	342,000	983,250	920,000
0.50	250.00	60.00	424,000	487,600	460,000
0.25	300.00	75.00	510,000	293,250	276,000
100.00			Totals	24,028,100	20,976,000

The products of unvented or imperfectly vented combustion, and ETS can be expected to have effects on respiratory health and be associated with excess acute respiratory illness as well as with excess chronic respiratory disease, although the precise relationships are far from being accurately known. For most of these contaminants the total population exposure indoors is likely to be found considerably in excess of the exposures incurred outdoors. This is due to the fact that often the concentrations indoors are higher than outdoors, and much more time is spent indoors than outdoors.

It is important to point out that exposures in the residential environment are to a considerable extent under the control of the occupants: they can limit the sources by choices they can make after being suitably informed, and they can limit the exposures by increasing the ventilation

rate. In almost all residential environments this can be accomplished by the simple expedient of opening windows or turning on exhaust fans. In inclement weather conditions this option may not be as readily available.

There are many environments such as offices and other non-industrial workplaces, with considerable public access, in which the occupants or visitors have no control over the ventilation rate in the indoor spaces, and in which they may have no control over the introduction of indoor air contaminants. Such environments often give rise to occupant complaints about the quality of the indoor air, with reports of one or more of a set of symptoms which have become known as the "sick building syndrome".

These symptoms include increased incidence of headaches, eye or nose and throat irritation, dry skin, lethargy or fatigue, cough, dizziness or nausea. It is often difficult or impossible to identify the pollutant(s) specifically responsible for such outbreaks, and the occupants usually report the cessation of symptoms upon leaving the building in question.

In many cases in which such buildings have been studied it was found that the ventilation was either inadequate or poorly distributed, or the outdoor air intake had been injudiciously placed near outdoor sources of concentrated pollutants such as loading docks. In some cases it is found that office machinery, or cleaning or maintenance materials, or the installation of new furniture or new carpets produce excessive levels of odorous or irritant pollutants.

The number of people thus exposed is not well known, but is suspected to be substantial. The effects they suffer may not have serious longterm consequences and may be quite reversible but are quite distressing at the time and give rise to considerable discomfort and stress. It is likely that the productivity of clerical and office workers under such conditions may be very seriously impaired. As our society expands the proportion of workers in service industries the indoor air quality in service industry workplaces may well become an important determinant of national productivity about which far too little is known.

With the considerable advances in the quality of ambient outdoor air which have been achieved in the U.S. with the implementation of the Clean Air Act amendments of 1970, and subsequent amendments there are now very few places in which the outdoor ambient concentrations make significant contributions to the air pollutant levels indoors.

Most outdoor air pollutants find their way into residential and other indoor spaces. In the absence of significant sources indoors, the indoor concentrations resulting from infiltration from outside would be lower than the outdoor concentrations. Several reasons contribute to this phenomenon.

Because of the much greater proportion of time spent indoors, the indoor concentrations then would dominate our total exposure. In fact, a number of pollutants, including radon daughters, volatile organic compounds, tobacco smoke, nitrogen dioxide, and respirable suspended particles tend to be considerably higher in concentration in the indoor environment.

Of the outdoor pollutants it is clear that ozone, photochemical oxidants, and sulfur oxides occur in lower concentrations indoors than outdoors, and therefore the total exposure of the population to these pollutants is in fact much lower than is indicated by the outdoor concentrations as monitored in the monitoring network. For these pollutants, the indoor environment is a safe refuge. For radon daughters, tobacco smoke, respirable suspended particulates, volatile organic compounds, including formaldehyde, and nitrogen dioxide the indoor environment contributes the major part of the population exposure.

It would be my opinion that the total exposure to air pollutants in the indoor environment is a much larger factor in avoidable health hazards from air pollutants, than the contribution made by exposures outdoors. This clearly should not be interpreted as reason to allow any deterioration in the outdoor ambient air quality: any such deterioration will immediately be reflected in all indoor environments. This reasoning does however indicate that much greater attention must be devoted to the indoor environment in terms of describing the exposures, the sources, and the measures which are available for occupants and owners to improve the indoor air quality.

The Environmental Protection Agency is clearly the lead agency of the Federal Government in the area of indoor air research activities, and has recently been given specific responsibilities in the area of radon and indoor air research. There is a Federal Coordinating Committee on Indoor Air Quality with representation from all federal agencies which carry out research on indoor air quality which meets with some regularity. It appears to serve more to inform different programs about activities of the others than as an active planning committee. The EPA recently requested an overview of its research activities by its Science Advisory Board, and a SAB Committee on Indoor Air Quality submitted a report to the Administrator in which it was suggested that it is very important that the Agency formulate specific objectives and goals, and that the formation of a unit with the specific responsibility proceed to these objectives and goals. In a letter to this Committee the Administrator indicated that its recommendations were being pursued. It is to be expected that the Agency in the report required by the Radon and Indoor Air Quality Research Act will have an opportunity to develop and state the objectives and approaches it proposes to pursue.

The relative significance and priority for different pollutants and issues really depend on goals and objectives: how much is the total population impact at this time, and how much improvement can be foreseen. A comprehensive and consistent approach to this setting of objectives and goals was recommended by the EPA SAB Committee on Indoor Air Quality. This process would assist in determining the most effective allocation of effort in a manner which would focus attention on the most important areas to emerge. Development of impact tables such as were presented earlier would be an important step.

In my opinion our rate of progress towards improving the quality of indoor air in the U.S. is slower than it could be and should be. The reductions in total population exposure to harmful pollutants which can be gained from improvements in indoor air quality are now greater than can be achieved by further improvements in the outdoor air quality. The processes

and approaches will be quite different: progress can only be made with the active cooperation of the population, and regulatory approaches will have a much smaller role.

Outdoor air quality could be improved and maintained for people, through government intervention. Indoor air quality can only be improved with people, by providing them with insight and advice which is responsible and effective . This insight and advice must be based on research which can only be done by the Federal Government. The private sector can and will do its part, but cannot be counted on to be as comprehensive, authoritative and credible as the Federal Government which has to lead. It will be necessary to increase the level of research effort after goals, objectives and strategies have been stated with sufficient clarity to justify and direct this increased effort.

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COMPREHENSIVE ENVIRONMENTAL PROTECTION FOR THE U.S. POPULATION

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The environmental legislation adopted and implemented since 1970 has brought about a very substantial reduction in the sources of human exposure to a wide variety of contaminants. One of the findings to come out of the implementation is that for many contaminants there are multiple sources, and our knowledge about the relative contributions made by each of these source modalities is quite inadequate and only beginning to develop.

It was clearly most important to provide protection from involuntary exposures to the major sources of contaminants in the general environment. With the existing legislation and the regulatory programs developed under this legislation these sources in the general environment are coming under reasonable control. In this process, a number of other sources and exposure pathways have been identified for which regulatory approaches are not feasible and further progress toward overall reduction in public exposures to environmental contaminants will have to rely on non-regulatory efforts. In many cases it appears that the relative contribution of exposures in the indoor environment to the total exposure is large, compared with the outdoor exposures which can be addressed via regulatory controls.

The progress in Total Exposure Assessment Methodologies made by EPA in recent years has taught us that for many contaminants major sources of exposure exist in environments which cannot and should not be regulated: the home environment, the office environment, and in general other environments which clearly can only be improved by individual choices and decisions. For many of these contaminants the exposure reductions which can be achieved by informing and advising households and building managers are much greater than can be achieved by further regulatory reductions in the general environment. Examples of pollutants for which the indoor exposures dominate are nitrogen dioxide, respirable particulate matter, radon, and volatile organic compounds.

A policy which pursues the avenue of Total Exposure Reduction to protect the public from unhealthful exposures would have a number of important elements which would have to be pursued essentially simultaneously:

1. Statement of the objective of Total Population Exposure Reduction in the legislative mandate for the Environmental Protection Agency

2. Establishment of personal exposures of a representative sample of the population, with reasonable attribution of different sources, and with the

intent of tracking changes in such exposures over time

3. Establishment of guideline values or exposure reduction goals for environmental contaminants as they originate from different sources, taking into account the total exposure from all sources as reported from population exposure assessments

4. Development of knowledge about the most effective exposure reduction strategies, and dissemination of information which will help individuals to make choices and decisions which will help them reduce their total exposure.

All of these elements are different from the approaches currently in use by EPA in carrying out its mandated tasks, and this difference reflects a difference in strategy: the goal is not primarily regulation, but the development of information, guidance and assistance. It should be made clear that the new approach cannot replace the regulatory activity which is aimed at reducing exposures not under the control of individuals, families or local communities, but that it extends assistance to those individuals, families and local communities wishing to reduce exposures in their immediate private environment.

Guidelines or recommendations could be developed which do not have regulatory implication but consist of advice based on consensus; such guidelines have been developed by WHO for a large number of substances, and for drinking water as well as air. The process presumably could be simpler and much speedier than the process now in place for NAAQS and drinking water standards. There is currently a severe lack of guidance and recommendations in the area of pollutant concentrations between Threshold Limit Values (TLV) and Occupational Standards which are available for a very large number of substances, and the official NAAQS which are available for only a handful of substances. It would seem appropriate for EPA to develop and provide this information given the appropriate mandate.

EPA maintains an extensive surveillance system over outdoor air quality, and on the quality of surface water, ground water, and drinking water. This system is mandated by and necessary for the regulatory effort, but it does not provide information about exposures in environments not under regulatory control. In order to provide for total personal exposure it is necessary to measure the exposure in a representative sample of the public over a suitable length of time, wherever these persons are. There has been substantial progress in our ability to do this type of measurement and for many substances this type of observation is well within the current capabilities. One round of this type of national assessment would contain 1000 to 2000 persons selected to assure representativeness, and it would involve perhaps a 24 hour active sampling of air or a one week passive sampling of air. The drinking water supply should be tested for each person in the sample, to capture any exposures due to private wells. This type of study would cost a fairly substantial amount, but it would provide the first nationwide assessment of total exposure of the population, of the distribution of this exposure, and of the distribution of the sources.

Comparisons of the distribution of exposures with guideline or recommendation values would identify targets for information and advice to

the population, and at the same time would help assure optimization of strategies for reductions of population exposures. Depending on the results which such a survey would produce, EPA could set goals for reduction over the next decade, and such reductions could be monitored during that decade by one or more repeats of the personal exposure survey.

It is worth noting that the Department of Health and Human Services formulated a number of goals for the health of the nation to be achieved by 1990 and the year 2000. These goals are for reduction in mortality and morbidity from a number of different causes. The goals are based on the conditions at the beginning of the current decade, and represent challenges for improvement which are difficult but not unattainable.

In a recent publication: "The 1990 Health Objectives for the Nation: A midcourse review" HHS reviewed the progress made towards the 1990 objectives. In the sections dealing with Toxic Agent and Radiation Control it was noted that much of the baseline data needed are unavailable, and that therefore progress towards objectives could not be documented.

The policy which is being proposed here would not only remedy this problem, but get EPA involved in a much more comprehensive program than it currently can pursue. The nature of the new approach clearly does not require authorization for new regulatory activity. It does however complement the regulatory approach in a manner which will assure that the regulatory and the advisory approach each will do what is most appropriate and effective thus improving the degree of total exposure reduction made available to the U.S. population. An additional advantage is that it will be possible to document both achievements and further potential for reduction of exposure when government and citizens each carry out their responsibilities.

ENVIRONMENTAL DEFENSE FUND

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Environmental Defense Fund

before

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the Senate Committee on Environment and Public Works

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On behalf of the Environmental Defense Fund, a national nonprofit membership organization with a 20-year commitment to reducing the risks of involuntary exposure to toxic agents in the environment, I am pleased to respond to your invitation to testify at these hearings on indoor air pollution. EDF has long been active in areas relating to the identification and control of risks related to environmental modifications and exposure to toxic chemicals. EDF as a member of the National Clean Air Coalition has joined in numerous presentations of testimony on issues related to indoor air pollution. This testimony is submitted by EDF. It draws upon our expertise in toxicology and risk assessment and particular experience with such major issues as asbestos, termiticides, formaldehyde, lead, and radon. In addition, I draw upon my experience a a member of the Board on Environmental Sciences and Toxicology, of the US National Academy of Sciences - National Research Council, a scientific group which published in 1985 the seminal report Epidemiology and Air Pollution.

EDF believes that exposures to substances in the indoor environment - in vehicles of transport, offices, businesses, schools, shopping malls, and homes - constitute significant risks to human health. While this is increasingly acknowledged by government, industry, and scientific researchers, EDF believes that current responses to mans particular problems identified in the indoor environment have been misguided and consequently ineffective. Too often when a new environmental issue is identified, it is manipulated as a means of trashing concerns raised over other issues. No where is this negative process more common, and more deleterious to our common goal of health promotion, than in air issues.

This testimony will be presented in the form of a discussion of several major issues of relevance in determining the importance of indoor air pollution, the types of health effects associated with exposures in this environment, sources of pollutants in indoor environments, and proposed solutions to current barriers to efficient and timely reduction in risks related to these exposures.

1. What is the indoor environment and the nature of air pollution in this environment?

The indoor environment is simply that space enclosed by structures in which people work, live, learn, travel, or otherwise spend time. The indoor environment differs most significantly from the ambient environment in two ways: it changes the patterns of diffusion and dispersion by reducing or altering air exchange, and it contains internal sources of substances which can enter the indoor

air space. The former factor is one of the most under-appreciated aspects of the indoor environment: many structures are deliberately designed to reduce air exchange to serve a range of purposes unrelated to air quality. The most drastic example is probably the environment of an airplane, where the indoor air is highly controlled. A recent study by the National Academy of Sciences (NAS) Board on Environmental Sciences and Toxicology on cabin air quality found it to be unacceptable for human health; recently, it has deteriorated because of new air recirculation practices designed to reduce fuel use. Our committee has in fact recommended to reduce the health risks of this drastic indoor environment that immediate steps be taken to (1) ban all smoking on airplanes and (2) to prevent persons from being held for unduly long periods on airplanes while on the ground.

The indoor air environment is affected by sources both external and internal to it. That is, indoor air is contaminated by materials contained in outdoor air - there is no intrinsic barrier to their entry through windows, doors, or ordinary ventilating systems. Vapors and particulates readily enter indoor air from the outside, so that we can assume that indoor air is likely to have <u>at least</u> the same concentrations of pollutants on the ambient air immediately on the outside of the enclosing structure. In fact the concentrations are in almost all cases likely to be higher in indoor air than in ambient, because the processes governing removal of contaminants in air are decreased in the indoor environment. Thus our houses, offices and schools can be effectively considered as traps for those contaminants in the outdoor or ambient air which gain entrance

inside. Radon is probably the best demonstration of this phenomenon. Radon is released from geologic sources and obviously exists in outside air; it is not created inside American homes, but it is inside homes that radon gas is prevented from ready diffusion and dilution so that it accumulates to dangerous levels, threatening the health of potentially millions of Americans. Particulates are also trapped in homes, resulting in accumulations of toxic substances attached to particulates, and significant contamination of the indoors. On average, concentrations of respirable particles are about 4 times higher in indoor air as compared to ambient air. The most comprehensive evidence of this issue relates to airborne lead, and the dangerous levels of lead found in housedust in homes near major point sources, such as smelters. In Philadelphia, in homes near the NL smelter, lead in housedust has been measured at levels up to 2000 ppm. Demonstrable health effects have been found in women and children exposed to soils and dusts contaminated with lead at concentrations of 100-200 ppm, or 10-20 times lower than this indoor measurement.

The indoor environment is also a source of toxic substances in the air, in addition to being a trap for materials coming from external sources. Formaldehyde and asbestos are the cleanest examples of toxic substances derived from materials in the very structure of indoor environments - insulation, particle board, fire - and sound-proofing. Certain practices limited to indoor environments - such as heating with woodstoves, cooling with gas, and treating wooden homes with termiticides - produce specific pollutants which are trapped inside and accumulated. Gas cooking, for instance, is

estimated to contribute, on average, as much as 2/3 of the daily exposure to NO_2 for most Americans.

2. What is the health significance of exposure to indoor air pollution?

As the examples cited above should indicate, some of the toxic substances found in indoor air are very dangerous. Radon, asbestos and formaldehyde are all recognized as human carcinogens; lead is a well known cause of human disease. Other substances which are accepted as risks in ambient air - volatile organics, other metals, polycyclic aromatic hydrocarbons - are incrementally more risky simply because of the attenuation of their dispersion and/or dilution in the indoors.

However, the real significance of indoor air pollution as a factor in human health relates more to exposure than to hazard. We must recognize that most Americans spend most of their time indoors. Many people even exercise indoors, increasing their ventilation rate and exposure to contaminants while inside. We now shop indoors and move from one enclosed environment to another, with very short encounters with the ambient. Certain populations are particularly likely to be indoors, such as the elderly, the sick, and the very young. Ironically, some of the susceptible populations whose protection is obligatory in the Clean Air Act, are likely to be at greatest risk of indoor air pollution. Thus even a substance found in relatively low concentrations in indoor air may be more significant, in terms of health risk, than a substance found in

higher concentrations outside. This relatively new pattern of behavior is not reflected in current approaches to exposure assessment.

3. What adverse health effects have been associated with exposure to air pollutants?

Our information on the health effects related to indoor air pollution is limited by failure to identify this environment as the medium of exposure. Formaldehyde has the largest body of information on health effects related specifically to indoor air pollution; a recent study, cited by the EPA in its grossly belated recognition of formaldehyde's carcinogenicity, found a 6-fold increase in site-specific cancers in persons living in mobile homes with formaldehyde sources. Adverse health effects were also found by CDC in persons exposed to pentachlorophenol released from lead-contaminated house dust is well-documented, and the process of transfer of lead from air to dust and thence into children is recognized as a major vector of lead poisoning, particularly for children (see USEPA, 1986, Ambient Air Quality Criteria Document for Lead). The health effects of exposure to indoor radon and asbestos are not yet counted, but we have sufficient experience from occupational exposures to these two carcinogens to develop reliable estimates of the burden of cancer mortality and morbidity from non-occupational indoor exposures. In these two instances, millions are at risk. The expected burden of disease from non-occupational exposure to radon has convinced many that it is likely to account for 40% of all lung cancers in this country. The

important prototype. More research of this type needs to be done, targetting specific populations such as the elderly, whose lifestyles increase their exposure to indoor air. We need more information on the relationships between ambient and indoor air, so that we can revise our environmental fate and transport models appropriately and recalculate certain ambient air quality standards as to the adequacy of their protection of indoor air quality. In the area of health effects, research is needed particularly on potential immunotoxic and neurobehavioral effects of materials in the indoor environment, particularly the volatile organics.

Research is needed on the impact of building design and HVAC engineering on indoor air quality. We must prevent a collision between goals such as energy conservation and health protection. Health studies, both experimental and clinical, are needed to assess the potential effects of specific exposures to substances in indoor air. Source of the greatest unknowns relate to the irritant/sensitization responses reported by exposed persons, and the neurotoxic effects known to be associated with chronic low level exposure to many organics singly, but unknown in combination. A high priority should be given to facilitating NIOSH investigations of "sick building syndromes".

5. Solutions

While research is needed as noted above, there are major actions which should be taken now to improve regulatory oversight and response to indoor air pollution. First and most important in a

political sense, we must expand our concept of ambient air to be consistent with the concept of where people are. There is no intrinsic barrier to adopting this conceptualization for regulations under existing provisions of the Clean Air Act. Second, we need to recognize the nature and sources of indoor air pollutants in order to provide guidance for rational and expeditious action.

It makes no sense to play indoor air pollution issues off against ambient air issues, as EPA is prone to do (see EPA Unfinished Business, 1987), since for many pollutants indoor air is only the proximate source of exposure and outdoor or ambient air is the ultimate source. In these cases, control of inputs into the ambient air will most effectively reduce contamination of indoor air; conversely, inclusion of the estimated risks associated with indoor air may assist in prioritizing and setting regulations for ambient air and emission limits under existing standards of the Clean Air Act.

Geologic releases - modifications of the earth - its crust and atmosphere are receiving more attention as major sources of risk and as subjects appropriate for protection by the EPA. The radon issue exemplifies the need for environmental regulators to transcend some of their self-imposed limits to consider approaches involving land use planning, development permits, and building design as methods to protect human health. These sources take on the aspect of natural disasters in terms of planning for response and remediation, and we should learn from the approaches used to prevent flood damage by incorporating zoning and land use planning into health protection.

Releases from products are probably the single most significant set of sources in terms of known human health impacts. Insufficient attention is paid to estimating exposure within indoor environments when such products are evaluated. Better integration between EPA and CPSC (and other agencies) through TSCA and other authority could assist in reducing this major source of risks. The most efficient regulatory action for these sources is preventive, evidenced in current approaches to formaldehyde and aesbestos. In some instances, it is the use of the product specifically within the indoor environment which confers the opportunity for exposure and risk. In these instances, regulation has been very late in catching up to the risks resulting from indoor use. The most recent example is the crisis over termiticides, such as chlordane, aldrin, and dieldrin. These old-style persistent nonspecific insecticides when used even in accordance with EPA's labels (under FIFRA) are now admitted by the EPA to cause dangerous contamination of indoor air and surfaces. This contamination was inherent in the use permitted by the EPA, that is, application to building structures. Another example is the failure to regulate water pollutants on the basis of indoor air contamination. Volatile organics move from water to air during such common uses of water as showering and cooking. Air exposure not only adds to the exposures from water, but it may be greater than exposure via consumption of water, and the toxic consequences may be more serious. In the case of solvents, inhalation will cause neurotoxic effects at much lower doses than ingestion, and these effects will be more rapid in onset.

In summary, EDF strongly commends the committee for its concern over indoor air pollution. Some of the most serious health effects associated with toxic substances have resulted from exposure to them in indoor air. Concerns over indoor air quality should not supplant or compete with concerns over ambient air quality. A systematic understanding of indoor air pollution is the best guide to risk reduction; this analysis indicates that ambient air, natural crustal sources, and consumer products are the most important sources of indoor air pollutants. Indoor air exposure is largely neglected in regulatory decision-making; it can be integrated into existing statutes but specific statutor's encouragement may be required. Research is most critically needed in the area of exposure assessment and in understanding how building design and product design lead to impacts on indoor air quality. Research, especially epidemiological studies, is grossly under-funded. Finally, EDF believes that active use of TSCA for its intended purposes as prevention is the most appropriate way to provide for control of products which are likely to contribute to indoor air pollution.

TESTIMONY

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BEFORE
SUBCOMMITTEE ON ENVIRONMENTAL PROTECTION
SENATE COMMITTEE ON ENVIRONMENTAL AND PUBLIC WORKS

APRIL 24, 1987

I AM JOHN D. SPENGLER, A PROFESSOR OF ENVIRONMENTAL HEALTH AT HARVARD UNIVERSITY SCHOOL OF PUBLIC HEALTH. FOR 15 YEARS WE HAVE ENGAGED IN AIR POLLUTION EXPOSURE AND HEALTH RESEARCH. CURRENTLY WE ARE FOLLOWING THE RESPIRATORY HEALTH AND LUNG DEVELOPMENT OF 15,000 CHILDREN AND 10,000 ADULTS LIVING IN 6 US COMMUNITIES. THROUGH THIS STUDY SPONSORED BY THE NATIONAL INSTITUTE OF ENVIRONMENTAL HEALTH SCIENCES, THE ELECTRIC POWER RESEARCH INSTITUTE, AND OTHER STUDIES SPONSORED BY THE U.S. ENVIRONMENTAL PROTECTION AGENCY AND GAS RESEARCH INSTITUTE, WE HAVE MEASURED OUTDOOR, INDOOR AND PERSONAL EXPOSURES TO A VARIETY OF POLLUTANTS; AMONG THEM ARE CO, NO_2 , PARTICLES, METALS, SULFATES, ACID AEROSOLS, OZONE, ORGANIC VAPORS, RADON AND BIOLOGICAL CONTAMINANTS. OUR SAMPLING HAS BEEN DONE IN URBAN AS WELL AS RURAL AREAS, IN HOMES, ARENAS, OFFICES, CARS AND AIRPLANES.

IN ADDITION TO MY RESEARCH AND TEACHING ACTIVITIES, I HAVE SERVED ON NATIONAL ACADEMY OF SCIENCES COMMITTEES INCLUDING INDOOR POLLUTANTS, PASSIVE SMOKING, AND AIRCRAFT AIR QUALITY AND SAFETY.

THESE EXPERIENCES HAVE LED TO THE DEVELOPMENT OF THE PERSPECTIVE THAT FOR NATIONAL PUBLIC HEALTH POLICY, WE SHOULD PREDICATE OUR REGULATORY AND NON-REGULATORY PROGRAMS ON EFFECTIVE CONTROL OF HUMAN EXPOSURES. ON THIS RATIONAL BASIS WE WILL MORE EFFECTIVELY DIRECT OUR ATTENTION TO THE SOURCES AND MEDIA (ROUTE OF EXPOSURE) THAT CONTRIBUTE MOST TO HUMAN HEALTH AND IRRITATION EFFECTS.

CLEARLY OUTDOOR AIR CONTAMINANT LEVELS ARE IMPORTANT AND DO CONTRIBUTE TO HUMAN EXPOSURES. IN FACT, FOR OZONE AND ACID PARTICLES, THE EXPOSURE RECEIVED WHILE OUTDOORS WILL BE THE MOST

IMPORTANT. IN THE ABSENCE OF INDOOR SOURCES, OUTDOOR CONCENTRATIONS WILL DIRECTLY DETERMINE INDOOR CONCENTRATIONS AS AIR INFILTRATES OR IS USED FOR VENTILATION.

HOWEVER, COMBUSTION, EVAPORATION, ABRASION, BIOLOGICAL GROWTH AND DIFFUSION OF RADON CAN OCCUR INDOORS, LEADING TO ELEVATED SHORT-TERM AND INTEGRATED EXPOSURES TO MANY CONTAMINANTS THAT CAN PRODUCE ILL EFFECTS IN HUMANS AS WELL AS DISCOMFORT AND MATERIAL DAMAGE. THESE EFFECTS ARE DOCUMENTED FOR ONLY A FEW CONTAMINANTS FOUND INDOORS. NEVERTHELESS, WE DO KNOW THAT CONCENTRATIONS OFTEN EXCEED THE LEVELS THAT ARE CURRENTLY BEING REGULATED IN THE AMBIENT AIR AND THE DESIGN CRITERIA LEVELS DICTATED FOR HAZARDOUS WASTE SITE CLEAN UP. THEREFORE, IT IS COMMON SENSE THAT WE DEVELOP A RATIONAL AND CONSISTANT POLICY FOR ADDRESSING HUMAN EXPOSURES TO ENVIRONMENTAL CONTAMINANTS.

THE SUBCOMMITTEE IS INTERESTED IN MY VIEW ON THE FOLLOWING TOPICS:

1. SERIOUSNESS AND EXTENT OF HEALTH THREATS POSED BY EXPOSURES TO AIR POLLUTANTS INDOORS

QUALIFIERS ARE NEEDED TO ANSWER THESE QUESTIONS. ON A WORKWIDE BASIS, WHERE HALF THE POPULATION HEATS AND COOKS WITH BIOMASS FUELS, MOSTLY UNVENTED, I BELIEVE INDOOR AIR POLLUTION EXPOSURES IS A SUBSTANTIAL LIFE-SHORTENING FACTOR. ACUTE RESPIRATORY INFECTION IS A MAJOR CAUSE OF EARLY CHILDHOOD MORTALITY IN THE DEVELOPING WORLD.

CAN WE EXPECT SUCH DRASTIC EFFECTS IN THE US? IN GENERAL THE ANSWER IS NO. THE EFFECTS WILL BE SUBTLE, DIFFICULT TO PERCEIVE AND QUANTIFY. WHERE EFFECTS ARE DELAYED IN TIME OR RESULT FROM CHRONIC EXPOSURES IT WILL BE DIFFICULT TO ATTRIBUTE CAUSALITY TO INDOOR SOURCES OR EXPOSURES. TO SAY THEN, THAT THE

HEALTH EFFECTS DUE TO INDOOR AIR POLLUTION ARE NOT IMPORTANT OR SUBSTANTIAL WOULD BE FAILING TO RECOGNIZE THE NATURE OF THE PROBLEM ENDEMIC TO ASSESSING ENVIRONMENTAL HEALTH PROBLEMS.

DEATHS DO OCCUR IN THE US FROM ACUTE EXPOSURES TO POLLUTANTS INDOORS. CARBON MONOXIDE (CO) FROM FAULTY COMBUSTION SYSTEMS, BLOCKED FLUES, USE OF UNVENTED CHARCOAL STOVES, ALL ARE NOTEWORTHY EXAMPLES. EXTRAPOLATING FROM MORE RECENT EVIDENCE THAT PASSIVE SMOKE EXPOSURES INCREASE RESPIRATORY ILLNESS IN CHILDREN, A SUBSTANTIAL INCREASE IN MEDICAL COST, LOST WAGES AND LOST SCHOOL TIME CAN BE SEEN. EVEN WITH ONLY A SMALL PERCENTAGE OF THIS NATION'S ANNUAL MORTALITY FROM CANCER (350,000) ATTRIBUTABLE TO INDOOR POLLUTANTS (RADON, ASBESTOS, PASSIVE SMOKING, FORMALDEHYDE, ORGANIC VAPORS), IT WOULD EXCEED ANY OTHER SINGLE CAUSE BESIDES TOBACCO SMOKE AND UV RADIATION. THERE IS GROWING EVIDENCE THAT THERE ARE CHEMICALLY SENSITIVE INDIVIDUALS IN OUR SOCIETY. MANY, IT IS BELIEVED, MAY HAVE ACQUIRED THE SENSITIVITY DUE TO CHRONIC EXPOSURES. BUT EVEN WITHOUT FRANK ILLNESS, THE SYNDROME OF IRRITATION, FATIGUE, SHROTNESS OR BREATH AND NAUSEA ASSICATED WITH BUILDING-RELATED PROBLEMS RESULTS IN LOST PRODUCTIVITY AND WASTEFUL INVESTIGATIONS AND LITIGATION.

THEREFORE, I BELIEVE INDOOR AIR POLLUTION DESERVES A HIGHER RESEARCH PRIORITY IN MANY OF THIS NATION'S RESEARCH AND REGULATORY AGENCIES AND DEPARTMENTS.

2. RELATIVE RISK OF VARIOUS INDOOR AIR POLLUTANTS

THIS IS A DANGEROUS QUESTION TO ANSWER AT THIS POINT FOR SEVERAL REASONS. RELATIVE RISKS ARE REALLY ONLY COMPARABLE IF THE UNITS ARE CONSISTANT SUCH AS LIFETIME RISK OF CANCER FOR AN INDIVIDUAL OR THE EXPECTED NUMBER OF CANCERS IN A POPULATION EXPOSED. THESE RELATIVE RISKS CANNOT BE COMPARED TO THE RISKS

ASSOCIATED WITH ONE ADDITIONAL RESPIRATORY INFECTION OR INCREASED EYE IRRITATION. IN SPITE OF THESE LIMITATIONS, I WILL ATTEMPT TO ANSWER THE SUBCOMMITTEE'S QUESTION. CANCER RISK RESULTING FROM POPULATION EXPOSURES TO PASSIVE TOBACCO SMOKE AND RADON APPEAR SIMILAR AND MIGHT RANGE FROM 2,000 TO 20,000 DEATHS PER YEAR. THIS IS ABOUT 1.3 TO 13% OF THE ANNUAL LUNG CANCER MORTALITY. YET, THE INTERACTIONS BETWEEN TOBACCO SMOKE AND RADON DAUGHTER PRODUCTS ARE NOT WELL UNDERSTOOD. EVEN AT THE LOW END PROJECTION, THE RISK IS MANY TIMES GREATER THAN THE RISK OF ROUTINELY OPERATING NUCLEAR POWER PLANTS.

THERE IS A FINITE CANCER RISK FROM INDOOR EXPOSURES TO VOLATILE AND SEMI-ORGANIC COMPOUNDS. THEY ORIGINATE FROM TERMIDECIDES, PESTICIDES, WOOD PRESERVATIVES, OIL AND WOOD COMBUSTION, ELECTRICAL FIRES, SOLVENTS, CLEANING COMPOUNDS, GLUES, RESINS, OFFICE MACHINES AND SUPPLIES, DISINFECTANTS, ODORANTS, AND HUNDREDS OF OTHER PRODUCTS AND MATERIALS. WHILE POPULATION RISK CANNOT BE QUANTIFIED ACCURATELY AT THIS TIME, THE MAJORITY OF THE US POPULATION IS EXPOSED REGULARLY TO MANY OF THESE COMMON SOURCES. COMPARATIVE RISK WILL PROVE TO BE SEVERAL ORDERS OF MAGNITUDE HIGHER THAN RISKS ASSOCIATED WITH HAZARDOUS WASTE SITES.

MANY CONTAMINANTS ARE SUSPECTED TO ATTRIBUTE TO RESPIRATORY SYMPTOMS AND EXACERBATION OF ILLNESSES. AMONG THE MOST UBIQUITOUS IS TOBACCO SMOKE. MORE THAN HALF OF THE CHILDREN IN AMERICA ARE DAILY EXPOSED TO THEIR PARENTS CIGARETTE SMOKE AT HOME. A PACK AND A HALF PER DAY SMOKER IS EXPECTED TO INCREASE THE CHILD'S FREQUENCY OF RESPIRATORY SYMPTOMS OR CHANCE OF EARLY CHILDHOOD LOWER RESPIRATORY ILLNESS BY 20-40%. WHILE THE OCCURENCE OF MOLDS AND MILDEW PROBLEMS IS LESS PREVALENT THAN

SMOKING, THE RISKS OF INCREASING RESPIRATORY SYMPTOMS APPEAR ABOUT THE SAME AS MATERNAL SMOKING.

STUDIES OF THE HEALTH EFFECTS FROM NITROGEN DIOXIDE EXPOSURES FROM UNVENTED COMBUSTION HAS LESS CONSISTANT RESULTS. THE RELATIVE RISKS APPEAR LESS THAN THOSE FROM TOBACCO SMOKE. NEVERTHELESS, EXPOSURES WERE NOT ADEQUATELY MEASURED NOR WERE THE MORE SENSITIVE POPULATIONS INCLUDED.

ASBESTOS IN BUILDING INSULATION AND DECORATIVE MATERIALS HAS THE POTENTIAL TO BECOME FRIABLE AND PRODUCE AIRBORNE FIBERS. OFTEN, FRIABLE CONDITIONS CAN BE EASILY DETECTED. TO DATE, EPA'S ASBESTOS PROGRAM HAS DE-EMPHASIZED RELIANCE ON AIR MEASUREMENTS. AS A RESULT, THERE HAS BEEN AN IRRATIONAL RESPONSE OF REMOVING ASBESTOS FROM SCHOOLS AND BUILDINGS BASED COMPLETELY ON ITS PRESENCE. IN MOST CASES, ACTUAL EXPOSURES TO ASBESTOS FIBERS HAVE NOT BEEN DOCUMENTED. I CONTEND THAT COSTLY AND POTENTIALLY MORE HARMFUL REMOVAL OF ASBESTOS HAS BEEN UNDERTAKEN IRRESPOSIBLY. ON THE OTHER HAND, ASBESTOS PLASTER IN PIPE AND FURNACE INSULATION WAS WIDELY USED IN HOMES. REPLACEMENT OF BOILERS, DAMAGE AND AGING OF PIPE INSULATION IS FAR MORE LIKELY TO CAUSE ASBESTOS EXPOSURES IN HOMES. YET EXPOSRUES TO ASBESTOS IN HOMES IS STILL INADEQUATELY STUDIED AND COULD REPRESENT THE REAL RISK.

3. PRIORITY POLLUTANT/SOURCES

THE AREA OF INDOOR POLLUTION HAS BEEN SO UNDERFUNDED THAT IT IS ESSENTIAL TO SIMULTANEOUSLY UNDERTAKE MULTIOBJECTIVE RESEARCH. THE FOLLOWING BRIEF LIST HIGHLIGHTS THE URGENT AREAS

<u>RADON</u>

-FURTHER CHARACTERIZATION CONCENTRATION AND EFFECTIVENESS OF CONTROLS

-INTERACTIONS OF TOBACCO SMOKE AND RADON

-EPIDEMIOLOGY TO ESTABLISH DOSE-RESPONSE RELATIONSHIP IN NON-MINER POPULATION

NO_2

-UNDERSTAND FACTORS INFLUENCING EXPOSURES IN PUBLIC HOUSING WHICH APPEARS TO BE AMOUNG THE HIGHEST OF ANY DEFINABLE GROUP

-ADDITIONAL EPIDEMIOLOGY WITH BETTER CHARACTERIZATION OF EXPOSURES AND HEALTH OUTCOMES

TOBACCO SMOKE

-UNDERSTAND AND CHARACTERIZE EXPOSURES AT HOME, WORK, PUBLIC PLACES

-IMPROVED INVESTIGATIONS ON THE NON-RESPIRATORY HEALTH EFFECTS OF PASSIVE EXPOSURE

BIOLOGICAL AGENTS

-UNDERSTAND FACTORS AND CHARACTERIZE INDOOR CONCENTRATIONS OF SPORES, BACTERIAL, ANTIGEN, VIRUSES, ETC.

-IMPROVE EPIDEMIOLOGY WITH DIRECT MEASUREMENTS AND CHARACTERIZING RESPONSIVENESS OF SUBJECTS

FIBERS

-CHARACTERIZE EXPOSURES TO FIBERS (ASBESTOS, FIBERGLASS, MINERAL FIBERS) ESPECIALLY IN HOMES

-IMPROVE UNDERSTANDING OF HEALTH AND IRRITANT EFFECTS OF FIBERS USING ANIMAL MODELS

VOLATILE ORGANICS

-DETERMINE EMISSIONS FROM PRODUCTS AND MATERIALS

-CONDUCT LONGITUDINAL STUDIES IN BUILDINGS, HOME , VEHICLES

-IMPROVE UNDERSTANDING OF IRRITANT EFFECTS

-BASIC RESEARCH ON TOXICITY OF VOC'S

4. INDOOR POLLUTANTS BY BUILDING TYPE

NO STRUCTURE IS EXEMPT FORM AIR POLLUTION POTENTIAL PROBLEMS. HOWEVER, BECAUSE OF THE VENTILATION AND HEATING SYSTEM CONSTRUCTION SOURCES AND ACTIVITIES, BUILDINGS MAY HAVE DIFFERENT TYPES AND CONTAMINANT LEVELS. BASED ON THE GENERAL TIME ACTIVITY PATTERNS OF PEOPLE, I HAVE CREATED A MATRIX OF POLLUTANT (SOURCES) BY BUILDING TYPE. I HAVE ATTEMPTED TO RATE THE PROBLEM IN TERMS OF NEEDED INFORMATION.

RATING OF HIGH PRIORITY EXPOSURE AND HEALTH RESEARCH

BY CONTAMINANT AND STRUCTURE

BUILDINGS	ETS	RN	BIOL	NO_2	FIB	VOC
HOMES - PRIVATE		H	H		H	H
- PUBLIC HSG	H		H	H	H	
SCHOOLS			H			H
OFFICE BLDGS	H		H			H
VEHICLES - AUTO	H		H	H		H
PLANES			H			H

5. RESPONSIBILITIES

THE INTERESTING ASPECT OF INDOOR AIR POLLUTION IS THAT RESPONSIBILITY FOR THE HEALTHFULNESS OF INDOOR ENVIRONMENTS IS SHARED. INDIVIDUALS, BUILDING OPERATORS, ARCHITECTS, BUILDERS, LANDLORDS, MANUFACTURERS, STATE AND FEDERAL OFFICIALS, AMONG OTHERS SHARE SOME RESPONSIBILITY. THEREFORE, BOTH PUBLIC AND PRIVATE RESEARCH CAN BE JUSTIFIED. CURRENTLY THE FEDERAL INDOOR AIR RESEARCH EFFORT IS DEVIDED ACROSS SEVERAL AGENCIES AND DEPARTMENTS. DOE'S, CPSC AND EPA`S PROGRAMS TO DATE HAVE ADDED SUBSTANTIALLY TO UNDERSTANDING INDOOR AIR POLLUTION AND HUMAN

EXPOSURES. BASED ON EARLY DRAFT REVIEW OF EPA'S REPORT TO CONGRESS, UNDER TITLE IV OF SARA (1986) "INDOOR AIR QUALITY INFORMATION ASSESSMENT, RESEARCH NEEDS STATEMENT AND IMPLEMENTATION PLAN, I AM VERY OPTOMISTIC THAT THE AGENCY WILL ACCORD IAQ THE HIGH RESEARCH VISIBILITY THAT IS REQUIRED. SUBSTANTIAL PROGRESS AWAITS CONGRESSIONAL RESOLVE TO PROVIDE LEADERSHIP ON ENVIRONMENTAL ISSUES BY ESTABLISHING PRIORITIES BASED ON RATIONAL UNDERSTANDING OF EXPOSURES AND EFFECTS RATHER THAN ON THE CHEMOPHOBIC FEARS OF THE PUBLIC.

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AMERICAN LUNG ASSOCIATION
The Christmas Seal People ®

STATEMENT OF THOMAS GODAR, M.D.

ON BEHALF OF

THE AMERICAN LUNG ASSOCIATION

TO THE

SUBCOMMITTEE ON ENVIRONMENTAL PROTECTION
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
UNITED STATES SENATE

RE: INDOOR AIR POLLUTION

APRIL 24, 1987

National Headquarters: 1740 Broadway, New York, N.Y. 10019-4374 · James A. Sweeney, Managing Director

Mr. Chairman, members of the Subcommittee, I am Dr. Thomas Godar, Director of the Pulmonary Disease Section at St. Francis Hospital and Medical Center, Hartford, Connecticut; Associate Professor of Medicine, University of Connecticut School of Medicine and Yale University School of Medicine; and in the active practice of chest medicine.

I am presenting comments today on behalf of the American Lung Association. ALA is the nation's oldest voluntary health organization and is dedicated to the prevention and control of lung disease. The ALA, along with its medical section, the American Thoracic Society, has long recognized the contribution of air pollution, both indoors and outdoors, to the development or exacerbation of lung disease. The ALA has been implementing programs to ensure healthful air quality since 1966. I have had the opportunity to appear before this Subcommittee on prior occasions to discuss ambient air pollution in the outdoor environment. Although the subject is indoor air pollution, the problems being explored this morning are very similar.

The Health Impact of Indoor Air Pollution

Traditionally we have believed that air pollution is primarily an outdoor problem and that the indoor environment provides protection from outdoor air pollution. As a pulmonary physician, I advise my patients at risk to the health effects of outdoor air pollution to remain indoors during times of unhealthful outdoor air quality. However, in fact, the indoor environment is perhaps more polluted, and the causes and effects less well investigated and understood than the particular problems of the outdoor environment. The average person spends from 75% to 90% of the time in this potentially unhealthful environment. The

magnitude and severity of this public health problem has been worsened by energy-conserving practices and the increased use of certain building materials and consumer products.

As with outdoor air pollution, the lung is both the portal of entry and primary site of injury when exposed to indoor air pollution. The populations considered sensitive to outdoor air pollution are also the same populations considered sensitive to indoor air polution--infants and young children, pregnant women, the elderly, and those with pre-existing chronic illnesses such as lung or heart disease. The effects are complex and manifestations of these effects may range from the most obvious such as eye irriation to the various disease states. The effects may occur qcickly upon exposure or become apparent only after delays of several days or even years. The effects are also complicated by the different concentrations and durations of exposure experienced in the indoor environment. The types of pollutants and effects include:

- **Biological aerosols** including aero-allergens--plant or animal materials--are capable of sensitizing some individuals and thereafter producing allergic reactions; aero-pathogens include bacteria and viruses.
- **Formaldehyde** is an irritating and probably carcinogenic gas emitted from several types of consumer products such as particle board, plywood, insulation and fabrics.
- **Radon** is a radioactive gas produced by radioactive decay of radium, an element widely distributed in the earth's crust which increases the risk of lung cancer.
- **Asbestos fibers** widely used previously in building materials can

cause asbestos-related lung disease including mesothelioma and lung cancer.

- **Carbon monoxide** is an odorless gas produced in any process of incomplete combustion such as that resulting from tobacco, gas stoves, and unvented or improperly functioning heating equipment. Carbon monoxide interfers with the supply of oxygen to the body's tissues.
- **Nitrogen dioxide** is a principal respiratory irritant that may interfere with the body's defense against respiratory infections. It is the product of high-temperature combustion such as from gas stoves unvented space heaters, and tobacco smoking.
- **Tobacco smoke** is comprised of more than 3,800 chemical compounds, most of which are toxic and sixty of which are known carcinogens. Involuntary smoking--exposure to tobacco smoke--is a cause of disease, including lung cancer, in healthy nonsmokers.
- **Household pesticides** are used inside approximately 84% of American homes. Of these households, between 4% and 5% of the residents are estimated to have experienced acute toxic reactions after use.
- **Household solvents** commonly contain butoxyethanol and xylenes for which there is some evidence of teratogenicity.

Options for Federal Control Policies for Indoor Air Pollution

Although indoor air pollution is recognized as a public health problem probably more serious than outdoor air pollution, the federal government has not acted to protect public health. To date no single federal agency has been given the jurisdiction for ensuring healthful air quality in the nonworkplace indoor

environment. A range of federal agencies has partial authority: the Environmental Protection Agency under the Toxic Substances Control Act has authority to control or limit the manufacture of hazardous chemicals and is also responsible for radiation; the Occupational Safety and Health Administation is responsible for ensuring a healthful workplace although this responsibility has not been interpreted as ensuring healthful air quality inside office buildings; the Department of Energy is responsible for energy conservation in homes and new buildings but does not address the impact of such policies beyond energy savings; the Consumer Product Safety Commission evaluates the health and safety effects of consumer products but has used this responsiblity only to a limited extent to address indoor air pollution from such products. These agencies and others also participate in the Interagency Committee on Indoor Air Pollution chaired by EPA to coordinate the indoor air pollution research activities of the federal government.

ALA believes that the primary obstacle to federal action to control indoor air pollution is this lack of clear regulatory authority. As such the ALA recommends that Congress give clear regulatory authority to EPA to ensure healthful indoor air quality. We recognize that such authority may require additional statutory authority. In this event, we would recommend amendment to the Clean Air Act to give the Agency clear authority for the control of air pollution both for the outdoor and indoor environments.

There are many design options that must be considered for development of a federal control strategy for indoor air pollution. Initial decisions must determine the extent of the jurisdiction--which indoor environments. ALA recommends authority to address indoor air pollution in residences, schools,

public access buildings and office buildings. The control program should contain a range of regulatory options to address the categories of pollutants, their sources and sites for exposure, appropriate control technology or mitigation measures, and implementation and enforcement activity.

The existing regulatory program within the Clean Air Act provides examples for many of these options. The basis of the regulatory activity for indoor pollutants of greatest public health concern should be a health standard--National Indoor Air Quality Standard. The process for setting such standards should be similar to that for the Act's National Ambient Air Quality Standard with similar principles for development--health based with an adequate margin of safety, protecting even the sensitive populations. Technology based strategies for meeting the standards should be used including product standards, ventilation standards, and building code standards. These technology based standards would then form the basis for implementation and enforcement activity. Adequate public information and education programs should also be emphasized in any regulatory strategy.

I do not want to over-simplfy the necessary regulatory strategy to address this critical problem. What I hopefully have done is describe the outline for a broad approach to resolving the problem. Having appeared before this Subcommittee on many occasions to discuss improving the Clean Air Act, I have learned that considerable work is needed to design and refine control strategies. Institutional questions must be resolved such as the relevant responsibilities of the federal, state, and local governments, timeframe for implementation, administrative and legal obstacles, budget and personnel resources, etc. The devastating problem of indoor air pollution mandates timely

action by the federal government. Without its guidance most state and local governments are unprepared to address the problems in their jurisdictions. What few programs are developed become pollutant oriented rather than problem oriented--for example, addressing radon or asbestos--and provide inconsistent protection to the public.

In the interim, there are many steps that can be taken. For example, EPA's public information and education programs can be expanded. ALA has noted that changes in personal behavior can be an effective control strategy for many indoor pollutants and their sources. Examples of these opportunities include the selection of nontoxic consumer products and building construction materials, elimination of exposure to tobacco smoke, and proper maintenance of heating, ventilating and air conditioning systems. Since the Surgeon General's findings regarding the health effects of involuntary smoking, efforts to restrict tobacco smoking indoors and increased public education about its dangers would constitute a significant mechanism for reducing exposures to this single most pervasive indoor air pollutant. Further interim steps should address improvement in consumer product labeling practices to include information on labels describing steps to minimize indoor air pollution caused by the product's improper use or storage.

Lastly, the ALA recommends expansion of the federal indoor air pollution research effort including budget resources. Considerable work remains to be done to characterize the nature and extent of the problem and the corresponding health effects, and to develop optimal control strategies.

* * *

In conclusion, Mr. Chairman, the ALA believes that we have sufficient knowledge about the health risks of indoor air pollution that federal intervention to control this public health problem is warranted. As ALA has advised about outdoor air pollution, we cannot wait for all of the answers before we take action--the American public deserves a safe and healthful environment, indoor and outdoors.

My name is Philip Merrill and I am speaking today on behalf of the Northern New England Indoor Air Pollution Project. This effort has been launched as a shared endeavor of the Maine State Employees Association, the State Employees Association of New Hampshire, and the Service Employees International Union, A.F.L.-C.I.O. This unique joint undertaking has been launched to develop and implement programs to cope with the most intransigent workplace safety issue facing today's wage earner: *sick building syndrome*.

As is clear from the literature on this subject, and from the testimony you have heard here today, indoor air pollution problem is making millions of people sick, and shortening many lives.

This problem has its greatest impact where people spend the greater part of their waking lives: at work.

In this post-industrial age, the office has become the workplace for most wage earners. The buildings being constructed to house these workers are built to appear pleasant and to be energy efficient. Typically the air is brought into these buildings and exhausted through mechanical systems, and typically these buildings are furnished with materials which would not be found in an indoor space just a few years ago. With new air systems and materials have come new hazards demanding new remedies.

In the case of the two best known indoor pollutants, asbestos and radon, the federal and state governments have made modest, but important beginnings.

As you know Mr. Chairman our state government in Maine has finally begun to face up to the problems posed by asbestos in our public buildings and schools, but this has only come after years of burying our heads in the sand and after this policy of neglect resulted in the closing our ten year old state library because asbestos was falling in chunks from the ceilings.

But focusing on these notorious offenders and our actions to date probably does more to distort the view of our current status. then it does to accurately define where we are in our efforts to assure a safe indoor environment. When this committee first wrote the Clean Air Act, it did not start with one pollutant, begin to deal with it, and then move to the next, and so on. If it had, the air we breath out of doors today in our urban areas, would be deadly. The approach used for outside air must be followed for inside air: we must approach it as a whole, and deal with each of the parts in the context of an overall strategy.

In developing this strategy you must of course first deter-

mine what the federal role should be, and then decide the appropriate involvement of the Environmental Protection Agency. I would like to address these two questions indirectly by telling you very briefly what we think is needed to begin to get ahead of this problem, and then relate how we are proceeding at the state level. This discussion will I believe suggest several modest, but meaningful ways that you can provide the leadership to move this country toward an indoor air policy.

The organizations represented in our coalition joined this project out of years of frustration. Faced with representing workers who were literally being made sick by the air at their worksite, we found in case after case our traditional tools did not work. So we came together and took inventory.We asked,what were the elements of any successful problem solving that were not present in these cases?

First on that list was a common awareness and understanding of the problem. We have found a virtual dearth of knowledge on the part of state policy makers or health professionals. The pollutants are invisible, and so is the problem to most of the professionals to whom we commonly turn when people are getting sick.

Second, we asked if there were appropriate standards to give us guidance and leverage as we attempt to fashion a solution. Again we found a vacuum. In all the standards that apply to workplace safety, and to clean air, and product safety, there are none that are designed to address the air people breathe at work.

Third, we found we did not know the cost of the problem. As we responded to problem buildings we would eventually gain some understanding of the causes and therefore,could begin to shape a solution At this point, one could determine the gross cost of remedial action, but could not begin to estimate the cost of inaction because the basic research has not been done. We have searched the literature and we have not found studies which provide these figures.

The difficulty in developing a common awareness of the problem can not be underestimated. In this respect it can be compared to acid rain. Not only can it not be seen but it is often a problem in environments that appear to be ideal.In response we are undertaking a major public relations effort and training program in northern New England. This is an area however, where the effort must be made on all levels and this hearing and the resultant actions could magnify all other efforts many times.

In the development of standards also, both state and the federal government have a role to play.

We need to define how much fresh air must be provided per

occupant, per hour. The heating and air conditioning industry have standards that they use for their purposes they make a good place to begin in developing government regulations. State governments can begin by setting standards for their own buildings and the E.P.A. could begin by creating similar rules for federal workplaces. These rules could next be extended to buildings where federal dollars help pay the lease.

As the understanding of this problem grows the demand that government act on a broader scale will create a climate in which these standards can be extended to all workplaces and public accommodations. In the meantime the E.P.A. and this committee will have gained data and experience.

Likewise we are going to have to learn what the minimum acceptable level of maintenance of these systems should be. Experience to date seems to suggest that in as many as a third of the cases where symptoms of sick building syndrome were present, the ventilation system itself was the breeding ground for the fungus or bacteria that was at the root of the problem.

When it comes to setting standards for the nationally manufactured materials that are put in the modern office building, we come to an area where we depend almost exclusively on federal action. How much formaldehyde should we permit a carpet to give off? The answer to that question and the thousands like it must spring from research conducted by the E.P.A. and from cost-risk judgments made by this committee and the Congress as a whole. That work must begin this year with this committee.

This brings me back to the third need, we need to begin to know the cost of this problem. For our part we are about to begin a survey of all our members in northern New England. We intend to follow that up with an extensive effort to look at ten or twelve buildings where the symptoms are the worse, and then look at health care costs, workers compensation claims, and lost sick days for,these buildings and compare this experience with that of all employees.

Such are our initial plans, but the federal government must take overall responsibility for advancing our knowledge, by helping to fund the research, by collecting and analyzing the data, and by providing the means to disseminate the information to other health experts and decision makers.

This is a brief and incomplete discussion of the action needed to tackle this problem. If the suggestions as to solution seem to fall far short in terms of the magnitude of the problem described, it is because our greatest fear is that the scope of the problem might deter you from taking any action. We've seen this too often at other levels of government.

We need your help and your leadership. The statement of "Findings and Purposes" of the Clean Air Act states "Congress finds...that Federal financial assistance and leadership is essential for the development of cooperative Federal, State, regional, and local programs to prevent and control air pollution." That same section goes on to state as the first purpose of the act, "to protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population."

In the light of that mandate I would hope you would provide that leadership now.

Thank you for the chance to present our views and for your attention to them.

STATEMENT ON
INDOOR AIR QUALITY

By

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Before the

Subcommittee on Environmental Protection
Senate Committee on Environment and Public Works

April 24, 1987

Chairman Mitchell and members of the subcommittee, my name is Laura Oatman and I work for the Minnesota Department of Health in the Division of Environmental Health. The purpose of my testimony is to summarize Minnesota's response to indoor air contaminants and discuss state level policy issues related to indoor air.

The role of government in protecting indoor air quality falls into three broad categories: research, public information/education, and regulation. While not a distinct category, communications and technology transfer must also be integrated in any effective response to indoor air pollutants. Even though Minnesota's early activities related to indoor air problems were reactive, the state's experiences can be used as examples of successful and unsuccessful government attempts.

There are several generic types of issues which have affected state level responses to health problems associated with "bad" indoor air.

1) One of the key elements in determining a state's response to an indoor air problem is the amount of "publicness" associated with the affected buildings. Users of public buildings have little or no control over their exposures while in that building. If an indoor air problem is found in several buildings (e.g., carbon monoxide in ice arenas) regulation may be the appropriate response since it safeguards the health of the general public and all users of those facilities will benefit equally. Historically, state governments have regulated public buildings, but are reluctant to attempt similar regulations for residences. Air quality in a home is frequently viewed as a personal choice, and government is reluctant to interfere with that choice.

2) Exposures that are voluntary should be treated differently from involuntary risks. One indoor air contaminant that is often voluntary and involuntary at the same time is tobacco smoke. Since smoking is a personal choice, banning it entirely in public buildings may not be the only appropriate government response. Instead, providing for a separation between individuals who choose to smoke and individuals who prefer to avoid tobacco smoke can be viewed as being a more equitable solution.

3) Finally, the health risks associated with the exposure to an indoor air contaminant must be considered when determining the nature of a government's response to a problem. For example, elevated levels of both formaldehyde and radon gas have been found in homes. At higher levels, formaldehyde is primarily an irritant and much of it is under the control of the homeowner. On the other hand, radon exposure is associated with lung cancer, and its presence in the home is usually inadvertent and involuntary. Using the same response for the two pollutants would not be appropriate.

4) Attempts to investigate or regulate the indoor environment are often hampered by the lack of adequate funds. Legislative mandates to conduct research or control specific problems frequently do not include the needed staff or resources.

5) Regardless of the role assumed by governments in safeguarding indoor air quality, communication plays a vital part in implementing that role. Within state government, Minnesota has organized the Indoor Air Quality Task Force to ensure communication between state agencies. However, a communication gap still exists between states and other levels of government.

MINNESOTA'S RESPONSE

Minnesota's response to indoor air problems in homes, public buildings, and non-industrial workplaces has mainly been reactive, and the state has historically responded to the issue on a pollutant-by-pollutant basis. The four state entities most interested in indoor air quality are the Energy Division, the Health Department, the Pollution Control Agency, and the University of Minnesota. The Pollution Control Agency regulates ambient air and its indoor air activities have focused on the criteria pollutants such as carbon monoxide and nitrogen dioxide, and upon developing air monitoring protocols. The University of Minnesota and the Energy Division emphasize the effects that ventilation, energy conservation, and structural characteristics may have on indoor air quality, especially the problem of excess moisture in buildings. Formaldehyde, radon, asbestos, tobacco smoke, volatile organic compounds, and polychlorinated biphenyls have been the focus of our Health Department's activities.

During the late 1960's, several episodes of illness were reported by users of indoor ice arenas in Minnesota. A subsequent survey of ice arenas in the state demonstrated that the exhaust of ice resurfacing machines resulted in levels of carbon monoxide and nitrogen dioxide which affected the health of people using the arena. More recent studies have found similar problems in Canada. Minnesota's response was to adopt regulations in 1973 limiting the level of carbon monoxide and nitrogen dioxide in enclosed sports arenas that use combustion engine-powered vehicles (Attachment 1). While no resources were dedicated to this regulatory program, periodic reminders are effective in improving the degree of compliance.

In 1975, Minnesota became the first state to regulate smoking in public places (Attachment 2). The Clean Indoor Air Act prohibits smoking in a public place or at a public meeting except in designated smoking areas. The Commissioner of Health adopted rules to implement the Act. The purpose of this law is to "...protect the public health, comfort and environment by prohibiting smoking in public places and at public meetings except in designated smoking areas". It is considered model legislation because it mandates that all public places, including places of work, be designated nonsmoking unless otherwise posted. Prior to its passage, traditional practice has been to allow smoking unless an area was posted as nonsmoking. The Minnesota law was the first comprehensive law because it covered publicly as well as privately owned buildings. The four exemptions to this law are individual private offices, private social functions (e.g., weddings), bars which serve meals to less than 50 persons, and federal facilities. Restaurants and public meetings were emphasized during the early years of the smoking regulations. More recently, public interest has shifted and we are now addressing more complaints regarding smoking in the workplace. Because no funds were provided to the responsible

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NOTE: The attachments referred to in this statement have been retained in committee files.

agency for enforcement, the smoking regulations were mainly self-enforcing until 1985 when a position was funded with the state's cigarette tax.

In the late 1970's, Minnesota was confronted with the issue of formaldehyde in residential buildings, primarily mobile homes. Between 1979 and 1981, our Health Department sampled over 900 homes for formaldehyde gas at the request of physicians whose patients attributed their symptoms to formaldehyde exposure. Public concern over residential exposure resulted in legislation directing the Department of Health to adopt rules governing the sale of building materials and residences containing urea formaldehyde. Our Department eventually adopted an indoor air standard of 0.4 parts per million which was later replaced with the U.S. Department of Housing and Urban Development product standard for building materials (Attachment 3). The regulation of indoor air in homes by using air standards is difficult because there may be a large number of sources of contaminants. Enforcement is virtually impossible because of the prohibitive costs of sampling for those contaminants.

Minnesota's experiences with public education efforts resulted from the fact that the state could not rely upon the news media to convey accurate information to the public. Fact sheets and informational brochures had to be developed. Numerous non-profit and professional organizations, such as the American Lung Association, Air Pollution Control Association, American Industrial Hygiene Association, American Society of Heating, Refrigerating, and Air-Conditioning Engineers, provided additional resources to expand the state's educational campaigns.

Government agencies frequently use regulations when responding to emerging public health concerns. However, Minnesota's experiences demonstrate that regulations are not always the appropriate response to indoor air problems. The most successful use of indoor air standards in Minnesota has occurred in public buildings. Limiting the levels of carbon monoxide and nitrogen dioxide in enclosed sports arenas, and providing smoke free areas in public buildings are regulations that protect the health of the general public, and users of the buildings benefit equally from government's intervention. These types of regulations usually receive the support of the general public. A poll conducted in May 1980, found that 92 percent of all Minnesota adults, and 87 percent of the heaviest smokers favored the state law which limits smoking in public buildings. Minnesota's regulatory experience with formaldehyde in homes was not as successful. Formaldehyde was initially regulated by the use of an air standard; this standard was later replaced with product standards. Setting an indoor air level for formaldehyde served the purpose of demonstrating to the forest products industry and builders that excessive exposure to formaldehyde was not to be allowed to endanger the health of new home buyers. Soon after adoption of the standard in Minnesota, low-emitting formaldehyde materials became available.

Minnesota's early response to indoor air issues was not coordinated among several state agencies which were interested in the area. To overcome these problems, 11 state agencies organized the Minnesota Indoor Air Quality Task Force in 1983. The objectives of the Task Force include: 1) the identification of various elements of the indoor

air problem in Minnesota as it is currently known, 2) the determination of the adequacy of the existing state governmental authority and activities related to indoor air issues, 3) the identification of areas where coordination between agencies was appropriate, and 4) the preparation of state agency budget requests for indoor air quality. Although several requests have been submitted to the state legislature, the establishment of a formal indoor air program and the designation of a lead agency in Minnesota is uncertain. Consequently, a cooperative effort between state agencies is necessary to avoid duplication of work.

Two products of the Minnesota Task Force are the development of an indoor air inquiry referral list (Attachment 4) and a homeowner's guide to radon. Since no single agency has overall authority for indoor air issues, requests for information from the public were often referred to several agencies before an appropriate contact person was located. The referral list was developed and distributed to the 11 member agencies. It is alphabetized by subject area and references the lead or contact agency for that subject along with a telephone number. The purpose of the referral list is to provide the public with consistent information on a particular subject while minimizing the number of referrals between agencies. The homeowner's guide to radon was prepared by several Minnesota agencies and universities to respond to the increasing number of public requests for information on radon.

Public concern over specific indoor air contaminants is usually the driving force behind a state agency's decision to investigate problems associated with a particular pollutant. Our Department records all public inquiries on indoor air, and averages over 60 telephone calls per week. The types of inquiries are evenly divided between homes and public buildings; however, complaints account for only 20 to 25 percent of the indoor air inquiries (Attachment 5).

BROAD POLICY ISSUES

Many states do not have adequate funds or staff to conduct detailed research on emerging health issues. Decision makers in state governments frequently adopt the position that state-generated tax dollars should not be used for research on problems of national scope or impact, but rather should be used to investigate problems unique to that particular state. If the problem is nationwide, the federal government should take the lead role in research.

As a matter of necessity, states will continue to be active in indoor air quality research. Citizens with complaints usually contact state and local health departments for information on indoor air, and these agencies often lack the necessary resources to be able to provide accurate responses to indoor air inquiries. This paucity of data forces states to conduct limited investigations on indoor air quality issues. One recent example, is the discovery of moisture damage in some homes manufactured by Tri-State Homes of Mercer, Wisconsin. Since all of the homes were located in Michigan, Minnesota, and Wisconsin, the federal government showed little interest in this problem. As a result, Wisconsin conducted an investigation of the air quality in these homes and the adverse health effects allegedly experienced by the occupants of the homes. Minnesota is requesting its Legislature to

provide funds to investigate possible low cost remedies for the excess moisture problem.

Another pollutant that many states are investigating is radon gas in homes. Since indoor radon levels can vary widely in different geographic areas of the United States, the data collected by the federal government or researchers in one state usually cannot be applied to other states. As a result, state governments need to conduct independent radon research in their own state.

While state and possibly local governments will retain a role in research activities, the federal government should take the leadership role in conducting some broad-based studies and in coordinating research done by individual states and academic institutions. Federal agencies cannot be expected to conduct or even fund all the research needed on indoor air issues, but they are in the best position to bring together the resources in state government, industry, consumer groups, and academic institutions to ensure a coordinated national research effort.

Providing information which is accurate and easy to understand is government's most important role in responding to indoor air problems. Educational materials are particularly useful in dealing with air quality problems in private residences because government agencies are reluctant to interfere directly with personal choice and lifestyle decisions.

Government agencies need to decide where their limited funds for educational materials can be used most effectively. As discussed earlier, the Minnesota Department of Health records the number and types of inquiries it receives on indoor air. The recording of inquiries not only allows our Health Department to rank indoor air subjects by frequency of requests for information, it also helps the Department to recognize new areas of public concern, such as radon gas. During the past three years, the Minnesota Department of Health has received about 400 calls on radon gas; over 350 of the inquiries were made in the last 14 months.

Regulation, through the setting of standards for indoor air must take into account the type and location of the exposure. Even though air standards might not be enforceable in most single or two family residences, they would be appropriate for high rise apartment buildings in which physical construction and ventilation are more like that found in offices and other public buildings. Even though large apartment buildings are private residences, the individuals living there have little or no control over their environment.

Similarly, the air quality standards of the Occupational Safety and Health Administration (OSHA) for industrial settings have been adopted to protect healthy workers over an eight hours per day interval. They should not be applied to employees located in a non-industrial workplace. Many people are using the terms "sick building" or "tight building syndrome" to describe the air quality problems that can occur in office settings. Even though the workplace includes both industrial and office settings, the health status of some individuals in non-industrial settings may make them more susceptible to adverse health effects from exposure to air contaminants. A different set of

standards or guidelines needs to be used for air quality in non-industrial workplaces.

The issue of indoor air quality is a complex one that is further complicated by the lack of clear cut authority in most states and at the federal level. It would be very beneficial to the states if Congress could designate a lead federal agency. The best choice appears to be the Environmental Protection Agency (EPA). However, there are some potential problems with this choice. The EPA usually interacts with the state environmental protection agencies, while indoor air programs are generally located in the state health agencies. This may require the EPA to establish new contacts within several states. In addition, the EPA should continue to rely on the expertise that currently exists in the other federal agencies regarding indoor air.

One way of overcoming the lack of communication between states and other levels of government, is the establishment of a federal level clearinghouse for indoor air. A clearinghouse would serve the needs of consumers, educators, consumer and environmental groups, health professionals, government officials, and industry. A key element of the clearinghouse would be a computerized reference service to locate information on specific subjects.

Achieving healthful air quality in the indoor environment is a complicated challenge, but it is not an impossible task. All levels of government, along with industry, non-profit organizations, and consumers need to work together to achieve this goal.

I would like to express my appreciation for having had this opportunity to share our Department's thoughts and concerns with you. I would be happy to respond to any questions you may have.

Consumer Federation of America

TESTIMONY OF

STEPHEN BROBECK

EXECUTIVE DIRECTOR

CONSUMER FEDERATION OF AMERICA

before the

SUBCOMMITTEE ON ENVIRONMENTAL PROTECTION

OF THE SENATE COMMITTEE ON ENVIRONMENT

AND PUBLIC WORKS

on

THE HEALTH EFFECTS OF EXPOSURE TO INDOOR AIR POLLUTION AND OPTIONS FOR REDUCING EXPOSURE

APRIL 24, 1987

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Mr. Chairman and Members of the Subcommittee, I am Stephen Brobeck, Executive Director of the Consumer Federation of America. CFA represents over 200 local, state and national consumer organizations with a combined membership of more than 30 million people.

I want to thank you, Mr. Chairman, and the members of this subcommittee, for convening this hearing and inviting us to testify. I also want to thank you for your leadership in focusing attention on indoor air pollution and in persuading the Senate to address this critical health issue. Especially encouraging was your inclusion last year of the Radon Gas and Indoor Air Quality Research Act in the 1986 Superfund Amendments.

The High Costs of Indoor Air Pollution

CFA believes that indoor air pollution represents the number one hidden health threat to our society. Each year radon, tobacco smoke, asbestos, formaldehyde, methylene chloride, and dozens of other toxic substances combine in indoor environments to kill tens of thousands of Americans and injure millions more. Moreover, because of reduced air exchange ratios due to improved weatherization, this threat has been increasing, not diminishing. Accordingly, we urge the federal government to make indoor air pollution a much higher priority.

Indoor air pollution imposes a high cost in terms of lives and dollars lost. The Environmental Protection Agency (EPA) now

estimates that indoor air pollutants (exclusive of radon) are responsible for 3500 to 6500 cancer deaths each year. Radon exposures alone may account for as many as 20,000 lung cancer deaths annually. Indoor air pollutants also cause millions of illnesses every year -- illnesses that cost this nation tens of billions of dollars in medical expenses and lost wages.

Recently, in large measure because of this subcommittee's concern, federal agencies have focused greater attention on indoor air pollution. But this federal attention is far from sufficient. As a nation, we have spent billions of dollars to improve the quality of outdoor air. Even the EPA, in a recent report, acknowledged that the seriousness of this problem warrants far greater attention. In its 1987 comparison risk assessment of 31 key environmental problem areas, EPA ranked radon first and indoor air pollution (other than radon) fourth in terms of a cancer risk to the population. Yet, the EPA itself concluded that, despite the magnitude of the health risk, the agency fails to give indoor air pollution commensurate priority.

Controlling Indoor Air Pollution Must Be
A National Priority

There must be a coordinated federal strategy to address indoor air pollution -- and make it a national priority. That effort must be directed by one lead agency with clear regulatory authority -- to formulate a comprehensive framework, to develop standards, to monitor implementation, to direct research, and to oversee a broad-based information and education initiative.

CFA believes that EPA is the most logical designee to lead this effort. EPA's experience in complex regulation of air quality under the Clean Air Act, its capacity for health-effects research and consumer education, and its current mandate for radon and indoor air quality research under the 1986 Superfund Amendments support this recommendation.

The designation of EPA as the lead agency, however, should in no way limit responsibilities of other federal agencies charged with other pieces of the indoor air pollution problem. The actions of the Consumer Product Safety Commission (CPSC) warrant particular attention. CPSC authority to set standards for consumer products plays the most critical role in controlling home exposure to indoor pollutants. EPA must be directed to work closely with CPSC, the Occupational Safety and Health Administration (workplace exposure), the Department of Energy (energy conservation standards), NIOSH (sick buildings), the National Institute of Occupational Safety and Health, the Department of Housing and Urban Development and other responsible federal agencies to improve indoor air quality control. In the past, EPA has inappropriately attempted to limit its regulatory and research role for indoor air quality control. Given the health dangers associated with agency inaction, neither EPA nor any other agency can be allowed to adopt this posture.

The reauthorization of the Clean Air Act is an opportune moment to begin to set that course, to clarify EPA regulatory authority for indoor air quality control, and to direct EPA to focus substantial

agency attention and resources -- beyond research -- on the problem of polluted indoor air.

A Comprehensive Strategy Must Be Developed

In so doing, CFA believes the subcommittee should consider both a comprehensive strategy to be crafted and those immediate federal initiatives which can limit consumer exposure to known toxic hazards. While the product-specific initiatives enumerated below are a step in the right direction, CFA believes that they cannot be the substitute for a long-term strategy. Rather, a comprehensive framework for control of indoor air pollution must be developed.

Based on what we currently know, the framework for this comprehensive strategy should incorporate ambient air standards, product standards, regulation of toxics, the development of model building code provisions, and methods for monitoring indoor air standards. The approach must respond to the nature of the structure, the health risk presented, and the product materials involved.

For existing non-residential, non-industrial buildings, indoor air pollution may be most effectively addressed by developing ambient air standards, which can be measured and monitored. State and local building codes would be the appropriate mechanism to set ventilation rates -- key to ensuring removal of many of the airborne pollutants.

For new construction, EPA, working in conjunction with other agencies and building code groups, should use the results of ongoing research to develop building design standards that minimize indoor air pollution. These standards, including ventilation rates, could

then be incorporated into model building codes for use by states and localities.

In considering a federal approach to indoor air pollutants in the home, it is clear that, except for pre-sale monitoring of mobile homes, enforcing ambient standards is usually neither practical nor appropriate. However, abatement measures by consumers can be encouraged through several federal initiatives:

(1) effective regulation -- through standards or ban -- of consumer products by the Consumer Product Safety Commission to preclude hazardous consumer products from entering and polluting the home;

(2) effective regulation -- through standard or ban -- of toxics and pesticides by EPA to preclude or limit possible known carcinogens from entering and polluting the home; and

(3) extensive public education about indoor pollutants, their health threats, and mitigation techniques, including the ready availability of this information for consumers.

Expanded Research is Critical

Fundamental to this strategy is the continuation of rigorous research. Therefore, CFA strongly urges that federal funding for research be significantly expanded above current levels. Exposure and concentration levels of individual pollutants, pollutant sources,

minimum ventilation rates, health effects and mitigation and control techniques must be identified to fashion an intelligent and comprehensive policy. The severity of the problem necessitates that the research be done expeditiously and that its results be disseminated in a form that is comprehensible and useful to consumers. Delays in providing adequate resources today will cost more in the long run.

The Radon Gas and Indoor Air Quality Research Act of 1986 is the first explicit authorization for a coordinated research effort by EPA. The funding authorized under this Act must be fully appropriated if critical research is to proceed and to answer fundamental questions. However, strong Congressional oversight is vital to assure that the goals of the Act are met.

Action Can Begin Now

We must not wait, however, for the final results of this research. Consumers are exposed to indoor pollutants at home, in their workplaces, and in schools -- on a daily basis. EPA must begin to:

(a) develop building design standards and minimum ventilation rates;

(b) grant technical assistance to states to implement the standards and existing mitigation techniques; and

(c) provide information to consumers, state and local agencies, builders, architects and manufacturers

Enough is known now about certain indoor air pollutants and their health hazards to warrant specific initiatives to reduce human exposure and the attention of this subcommittee.

Radon: As this subcommittee is by now well aware, indoor exposure to radon gas progeny is thought to cause up to 20,000 lung cancer deaths each year. Although a recent EPA report estimates that one in every eight American homes may exceed the 4 picocurie per liter action level (triggering EPA recommended remedial action), many consumers still remain unaware of the radon hazard -- a hazard that can be successfully mitigated.

The State Radon Program Act, pending before this subcommittee, would direct EPA to expand technical assistance to states for radon control and provide grant assistance to initiate radon programs in states where they do not exist. CFA strongly supports this important initiative to mitigate the hazardous effects of radon which continue unabated. We also endorse the Radon Detection in School Buildings Act so that the extent of radon contamination can finally be determined in our nation's schools.

EPA, through technical assistance, continued research and expanded public education, is the one agency which can and must take a visible and aggressive lead in radon control.

Radon, though, is only one of the indoor air pollutants that pose known health threats. Others also merit immediate Congressional attention:

Asbestos: Inhalation of asbestos fibers is known to cause lung cancer and cancer of the lining of the thoracic and abdominal cavities. Yet millions of Americans continue to be exposed to friable asbestos in the workplace, in the home and in public buildings, including schools. This subcommittee also has before it legislation requiring EPA to set standards for identification and abatement of hazardous asbestos in Federal and other generally public buildings. CFA strongly endorses this critically needed legislative initiative.

CFA is concerned, though, that asbestos continues to be used in consumer products. It has fallen between the regulatory cracks of EPA and CPSC; neither agency has taken any action to ban its use. This continued introduction of a known human carcinogen into the home presents a ready target for Congressional action. To avoid the costly health effects of continued exposure to asbestos, an immediate ban is necessary.

Environmental Tobacco Smoke (ETS): Numerous studies show that exposure of non-smokers to tobacco smoke increases the risk of lung cancer and acute respiratory disease, particularly among children. One study indicates that children whose parents smoke at home have 30% more lower-respiratory illnesses than children in non-smoking families.

A 1986 report of the National Academy of Sciences estimates 2,400 lung cancer deaths from home exposure to environmental tobacco

smoke. The figure far more than doubles when work place exposure is included.

Although tobacco smoking is a voluntary risk and a pollutant that can be controlled by behavior, we believe legislation is needed to limit tobacco smoke in public places including all federal buildings and to ban its use on airplanes, consistent with the recommendation of the National Academy of Science. Legislation should also contemplate the development of model code provisions, limiting ETS, for implementation by states and localities.

Formaldehyde: Used in more than 3,000 consumer products, formaldehyde has long been known as an irritant to eyes, skin, nose and throat and the cause of respiratory tract irritation, nausea, headaches and lethargy. Just last week, EPA confirmed that formaldehyde is also a probable human carcinogen. In its comparative risk assessment report, EPA indicates that consumer exposure to formaldehyde results in an estimated 50 cancer deaths per year.

Particleboard, hardwood plywood, and medium density fiberboard are three types of pressed wood products which use a urea formaldehyde resin. Consumers are exposed to formaldehyde when they inhale the emissions from these products.

Yet CPSC -- the federal agency which has clear authority to limit consumer exposure to formaldehyde emissions from pressed wood -- has failed to act accordingly. CFA petitioned CPSC to set a mandatory standard for an emission level that would provide adequate protection for human health. CPSC denied this petition. Instead,

CPSC, underestimating the chronic risks and ignoring the acute human risks, chose to rely on an inadequate voluntary standard. As a result, consumers are exposed to higher formaldehyde emissions than necessary; Congressional action through oversight could limit this exposure.

Chemicals in consumer products: There are an estimated 10,000 chemicals found in consumer products -- products ranging from cleaning agents to paints, pesticides and home furnishings.

A particular concern is the widespread use of methylene chloride, a multi-purpose solvent. Of the approximately 584 million pounds of methylene chloride produced in this country annually, over 50% is used in paint strippers and aerosol products. Long associated with central nervous system diseases, methylene chloride is now estimated by EPA to cause 30 cancer deaths annually. CPSC has characterized methylene chloride as presenting one of the highest cancer risks ever calculated for a chemical in a consumer product.

Despite a CFA petition filed with CPSC nearly two years ago, consumers are still not warned of the cancer risks posed by methylene chloride. Nor has a ban or standard been imposed, as rulemaking drags on. We hope Congress will monitor this proceeding to assure it occurs expeditiously.

Consumer exposure to this solvent, in addition to other such pollutants in consumer products, can and must be limited by federal action. Research and standard setting, or at a minimum, consumer education and labeling require continued federal involvement.

Chlordane: A known carcinogen, chlordane was banned in the 1970s except for use in termite control. Millions of Americans have their homes treated annually for termites. Chlordane and two other similarly carcinogenic pesticides are used 90% of the time as the termiticides. Studies now show that even professional use of the pesticide does not prevent the chemical residues from contaminating the home, exposing the resident to a serious health threat and potential property damage that is irreversible. EPA has the authority to ban this pesticide under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). We urge this subcommittee to include action on chlordane in the upcoming FIFRA authorization hearings.

These pollutant-specific initiatives, while not exhaustive of immediate actions to be taken, reflect effective steps to significantly reduce exposure -- as we begin to develop a comprehensive indoor air strategy. The unchecked exposures in the home, the workplace, and public buildings necessitate these expeditious actions.

Demonstration Program in Federal Buildings

The workplace is the site of many indoor hours for most consumers. Yet individual consumers have little or no control over the quality of the air they breathe.

The federal government manages hundreds of buildings around the country and funds the construction of new buildings annually -- work sites that affect the health of tens of thousands of federal workers.

In contemplation of a comprehensive strategy, the subcommittee should direct EPA to conduct a demonstration program in federal buildings. The program could monitor for and mitigate pollutants in existing sites and test and evaluate current mitigation techniques, building design standards, and minimum ventilation rates in new construction.

Such a program would be an opportunity for the federal government to take a leadership role in controlling indoor air pollutants. It is an opportunity to use the fruits of current research to show that workplaces can be made safer. Senator Stafford's proposal to address asbestos in federal buildings is an example of the direction that this demonstration program could take one step further.

Prevent Consumer Fraud in Testing and Mitigation

CFA is also concerned about the potential for consumer fraud in testing and mitigating indoor air pollution problems. We already know of contractors who claim that they can take radon measurements with an empty mayonnaise jar or a geiger counter. CFA believes that Congress should direct EPA to study this problem in cooperation with state and local agencies and, where appropriate, provide states with technical assistance in addressing deceptive practices. Certification of qualified firms for testing and mitigation is one means to head off the problem. Because of the technical nature of indoor pollutant monitoring and mitigation, consumer education by EPA would also be an effective measure to assure that such indoor air fraud is recognized and precluded.

Clearinghouse Needed to Disseminate Public Information

Consumer information is also of vital concern to CFA. Available research must be translated and disseminated in a way that is useful for both consumers and decision makers.

CFA proposes the immediate establishment of the Indoor Air Quality Information Clearinghouse to provide objective and consistent information to the consumer, to local, state and national agencies, to health professionals, to architects and builders, and to industry.

The Clearinghouse would serve several key functions: a telephone "hotline" to disseminate non-technical information to consumers; a comprehensive reference service on research and human resources; and a newsletter, reporting advances in research and control efforts.

In cooperation with consumer and citizen groups, public utilities, industry, scientists, health organizations, and government agencies, CFA has begun to develop the Clearinghouse. A significant opportunity for public/private partnership, the Clearinghouse would be a newly-created non-profit organization. The board of directors would represent all sectors -- public and private -- concerned with indoor air pollution.

Proposed late in 1986, the Clearinghouse has already received the strong endorsement of 12 organizations representing broad private and public interests. The organizations include: Southern California Gas, American Lung Association, Oak Ridge National Laboratory, Chemical Effects Information Group, New Jersey State Health Department, Michigan Citizens Lobby, Center for Residential

Health (MA), Colorado Project/TIP, Inc., Pacific Gas and Electric Company, National Capital Area Lung Association and three private companies. Other groups such as the Sierra Club have the proposal under review.

To meet the rapidly growing need for information from consumers and from all levels of the private and public sector, the Clearinghouse should be made operational by FY 1988, at an annual estimated cost of $1 million. We request this subcommittee to match private support for this clearinghouse by including $500,000 in the EPA budget authorization for FY 1988.

The Clearinghouse represents a cost-effective means of coordinating current information, transmitting it, and creating a central research bank. It will prevent duplication of research efforts and facilitate exchange of technical information and experience among public and private groups in various states around the country.

We have presented many ideas today for consideration. But research, regulation and education are all vital components of this effort. Only by constant and persistent attention will people finally confront the threat posed by indoor air pollutants -- a threat that in the face of inaction, ignorance and apathy grows daily.

On behalf of CFA, I strongly urge this subcommittee to continue its commitment to defining and dealing with the problems of indoor

air quality in a comprehensive fashion. Every delay subjects consumers to risks to their health which can be avoided and prevented.